

**SORENTO(BL) > 2007 > G 3.3 DOHC > General Information****General Information > General Information > General Information****IDENTIFICATION NUMBER DESCRIPTION**

Vehicle identification number

<b>K</b>	<b>N</b>	<b>D</b>	<b>J</b>	<b>C</b>	<b>7</b>	<b>3</b>	<b>5</b>	<b>□</b>	<b>6</b>	<b>A</b>	<b>000001</b>
1	2	3	4	5	6	7	8	9	10	11	12-17

1 : Geographic zone

- K = KOREA

2 : Manufacturer

- N = Kia motor company

3 : Vehicle type

- D = MPV

4 - 5 : Vehicle Line/Series

- JC = Sorento (4WD)

- JD = Sorento (2WD)

6 - 7 : Body Type

- 73 = 4 Door SUV &amp; GRW 2271 ~ 2720 kg

8 : Engine type

- 5 = λ3.3

- 6 = λ3.8

9 : Check digit

10 : Model year

- 5 = 2005, 6 = 2006, 7 = 2007

11 : Plant location

- A = Hwasung Plant

12 - 17 : Production sequential number

- 000001 ~ 999999

**ENGINE IDENTIFICATION NUMBER**

<b>G</b>	<b>6</b>	<b>D</b>	<b>A</b>	<b>5</b>	<b>000001</b>
1	2	3	4	5	6

1. Engine fuel

- G : Gasoline

2. Engine range

- 6 : 4 cycle 6 cylinder

3. Engine development order

- D : Lambda engine

## 4. Engine capacity

- A : 3778cc
- B : 3342cc

## 5. Production year

- 5 : 2005, 6 : 2006

## 6. Engine production sequence number

- 000001 ~ 999999

## LUBRICANTS

**Recommended Lubricants**

Parts		OIL & GREASE STANDARD	
Engine Oil	Gasoline	API SJ or SL	SAE 5W -20
		If 5W-20 engine oil is not available, 5W-30 or secondary recommended engine oil for corresponding temperature range can be used.	
Transaxle	Auto	DIAMOND ATF SP-III, SK ATF SP-III	
Power Steering		PSF - 3	
Breake Steering		DOT 3 or equivalent	
Coolant		Ethylene glycol base for aluminium radiator	
Transaxle linkage, parking breake cable mechanism, hood, door latch, seat adjuster, tailgate latch, door hinges, tailgate hinge		Multipurpose grease NIGL grade #2	

**Lubricants capacities**

Description		3.8 (G6DA)	3.3 (G6DB)
Engine oil	Oil pan	5.5 (5.81, 4.84)	5.5 (5.81, 4.84)
	Oil filter	0.4 (0.42, 0.35)	0.4 (0.42, 0.35)
	Drain and refill	5.7 (6.02, 5.02)	5.7 (6.02, 5.02)
	Total	5.9 (6.23, 5.19)	5.9 (6.23, 5.19)
Cooling system		8.9 (9.40, 7.83)	8.9 (9.40, 7.83)
Automatic transaxle		10.9 (11.51, 9.59)	10.9 (11.51, 9.59)
Power steering		0.9 (0.95, 0.79)	0.9 (0.95, 0.79)

**WARNING**

Always use Genuine Kia parts and recommended fluid.

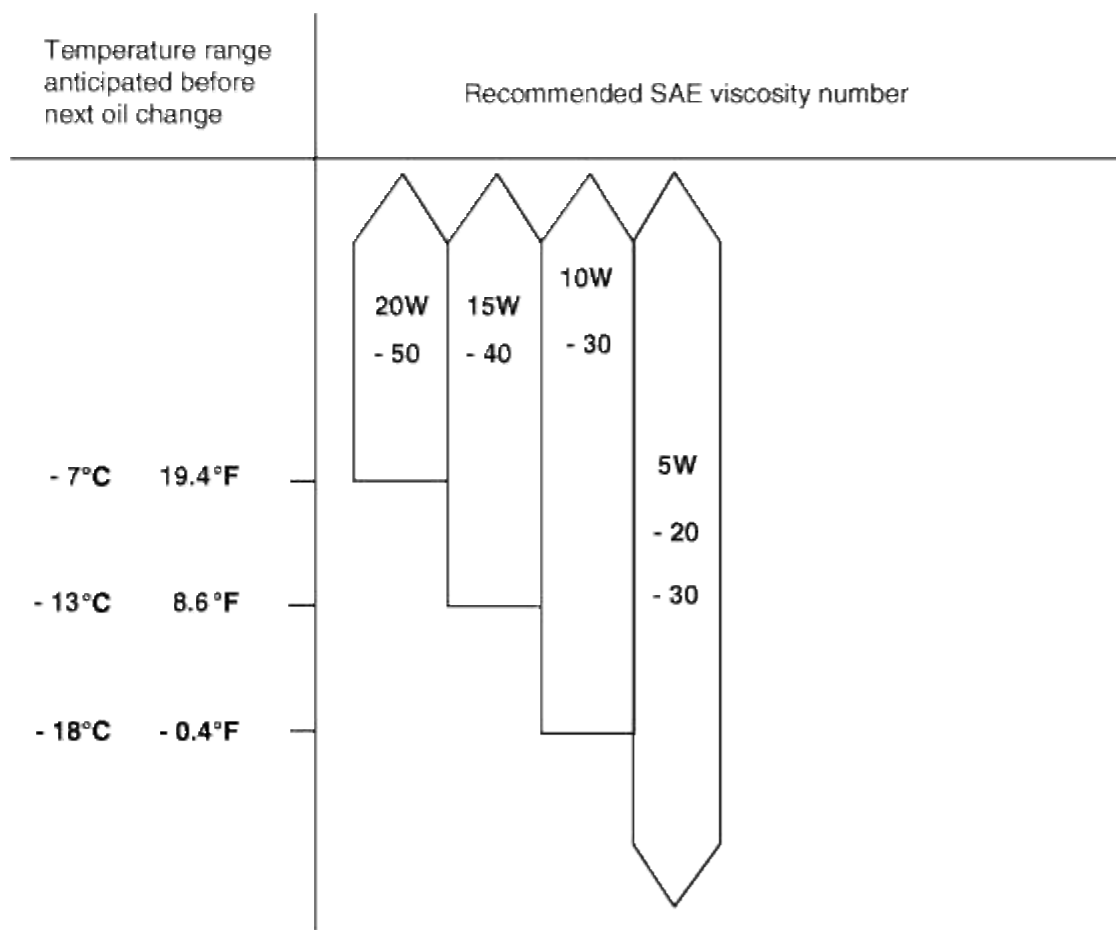
Using any other type of parts and fluid can cause serious damaged if the vehicle. **RECOMMENDED LUBRICANTS.**

## Selection of Engine oil

Recommended API classification : SJ or SL ABOVE

Recommended SAE viscosity grades : 5W-20 (If 5W-20 engine oil is not available, 5W-30 or secondary recommended engine oil for corresponding temperature range can be used.)



**NOTE**

For best performance and maximum protection of all types of operation, select only those lubricants which.

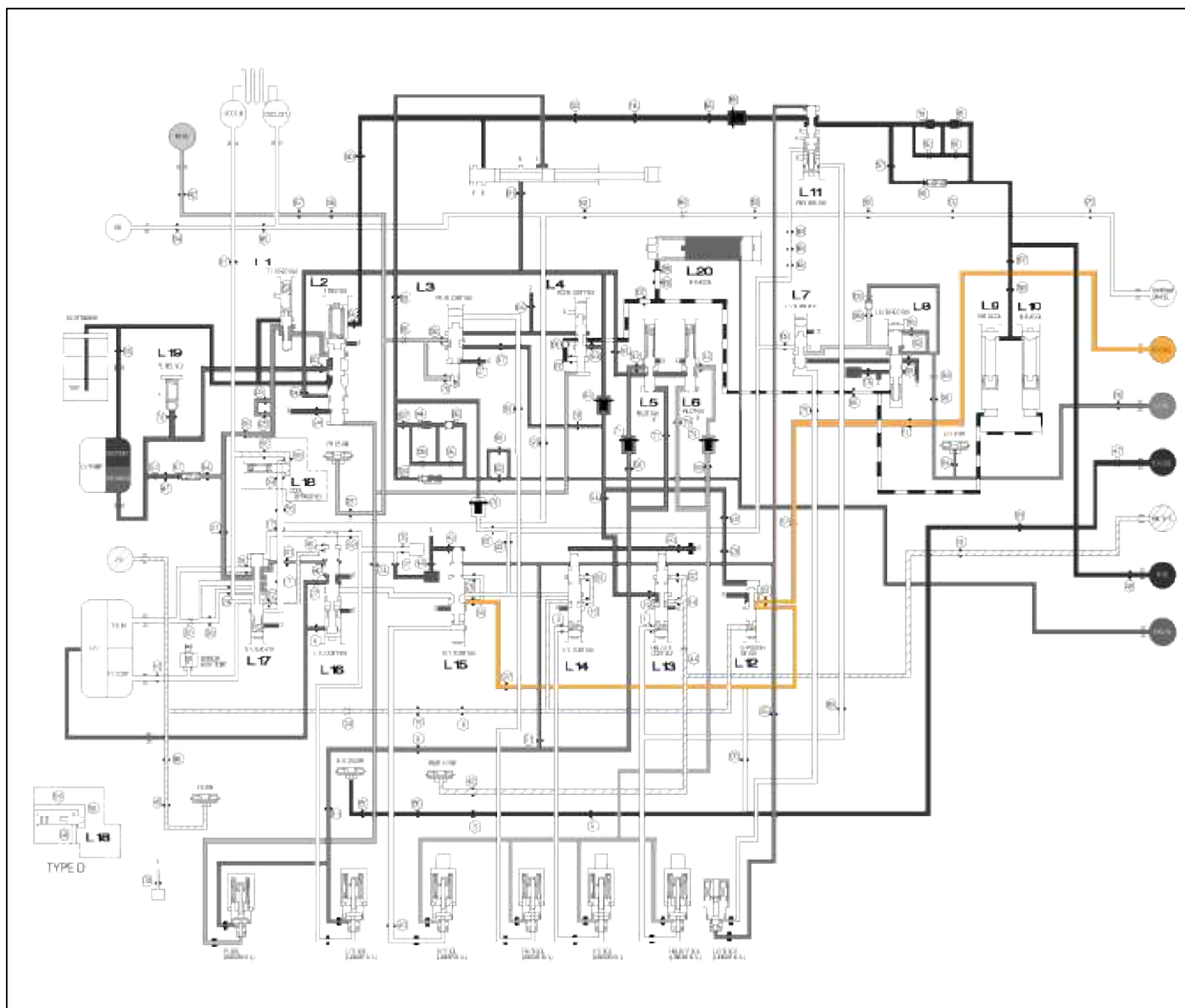
1. Satisfy the requirements of the API classification.
2. Have the proper SAE grade number for expected ambient temperature range.
3. Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

**SORENTO(BL) > 2007 > G 3.3 DOHC > Automatic Transaxle System****Automatic Transaxle System > General Information > Specifications****SPECIFICATION**

Type			A5SR1	A5SR2
Driving system			2WD/ 4WD	
T/CON	Type		3 elements, 1 stage, 2 phase	
	Identification inscription [Nominal diameter (mm)]		8 (Φ250)	8 (Φ260)
	Stall torque ratio		1.76	1.84
Transmission	Manipulating system		Remote control flow transmission (Cable method)	
	Shift position	P	Fix output axle (Engine start allowed)	
		R	Reverse	
		N	Neutral (Engine start allowed)	
		D	1↔2↔3↔4↔5	
	Gear ratio	1st	3.827	
		2nd	2.368	
		3rd	1.520	
		4th	1.000	
		5th	0.834	
		Reverse	2.613	
		Final gear ratio	3.333	
	Control method		Electronic control	
	Function	Lock-up control	Equipped	
		Operating fluid pressure control	Equipped	
		Real time feedback transmission control	Equipped	
		Transmission pattern auto change control	Equipped	
		Self-diagnosis control	Equipped	
		Fail-safe function	Equipped	
		Sports mode function	Equipped	
	Speedometer gear teeth (drive/driven)		6/14	
	Oil pump	Type	Trochoid oil pump	
		Driving system	Engine drive	
	ATF oil	The recommended	APOLLOIL ATF RED-1K or Kia Genuine Red-1	
		Quantity	10ℓ(10.57 US qt, 8.8 Imp.qt)	

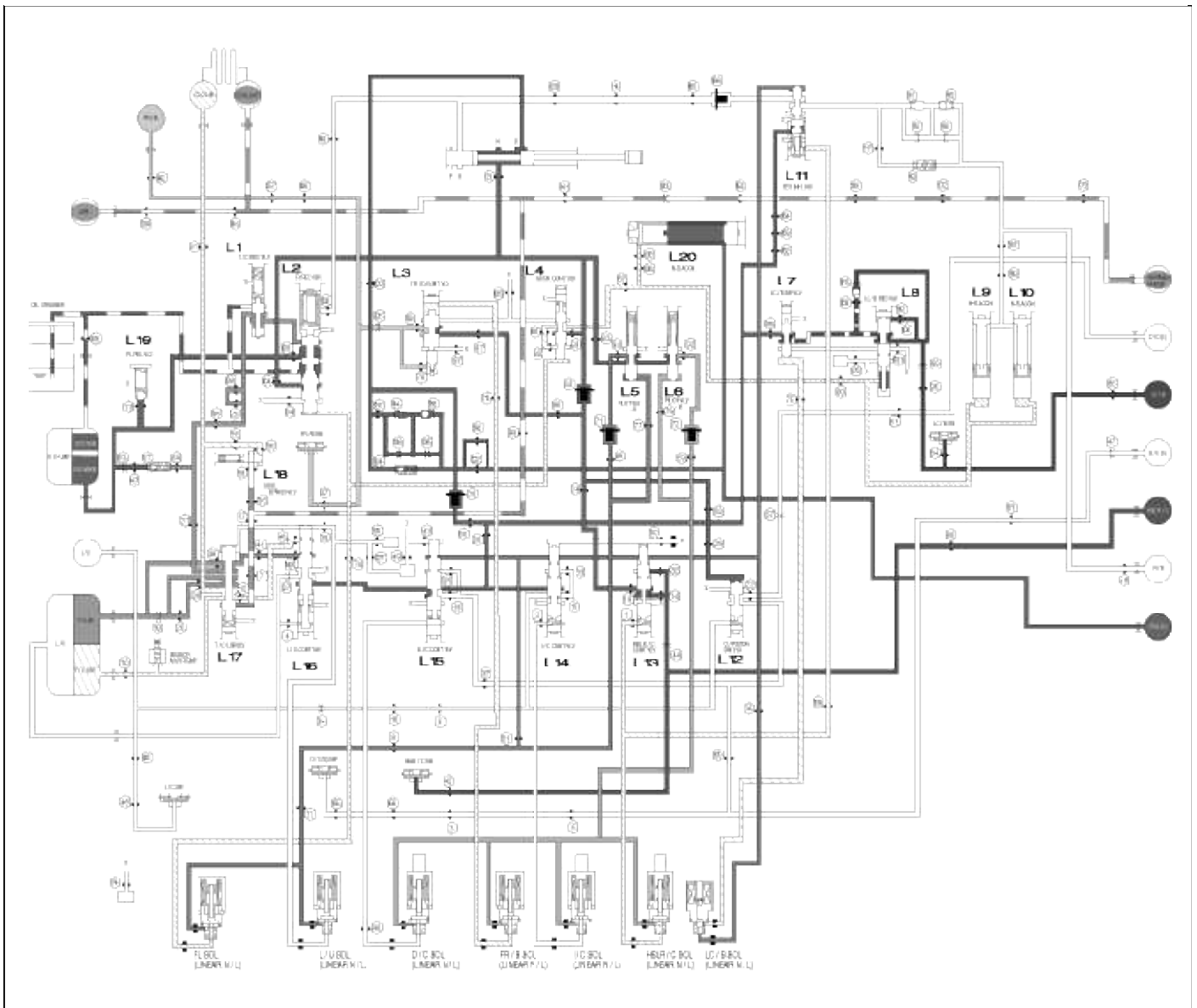
# Automatic Transaxle System > Automatic Transaxle System > Flow Diagram

## VALVE BODY fluid pressure circuit diagram

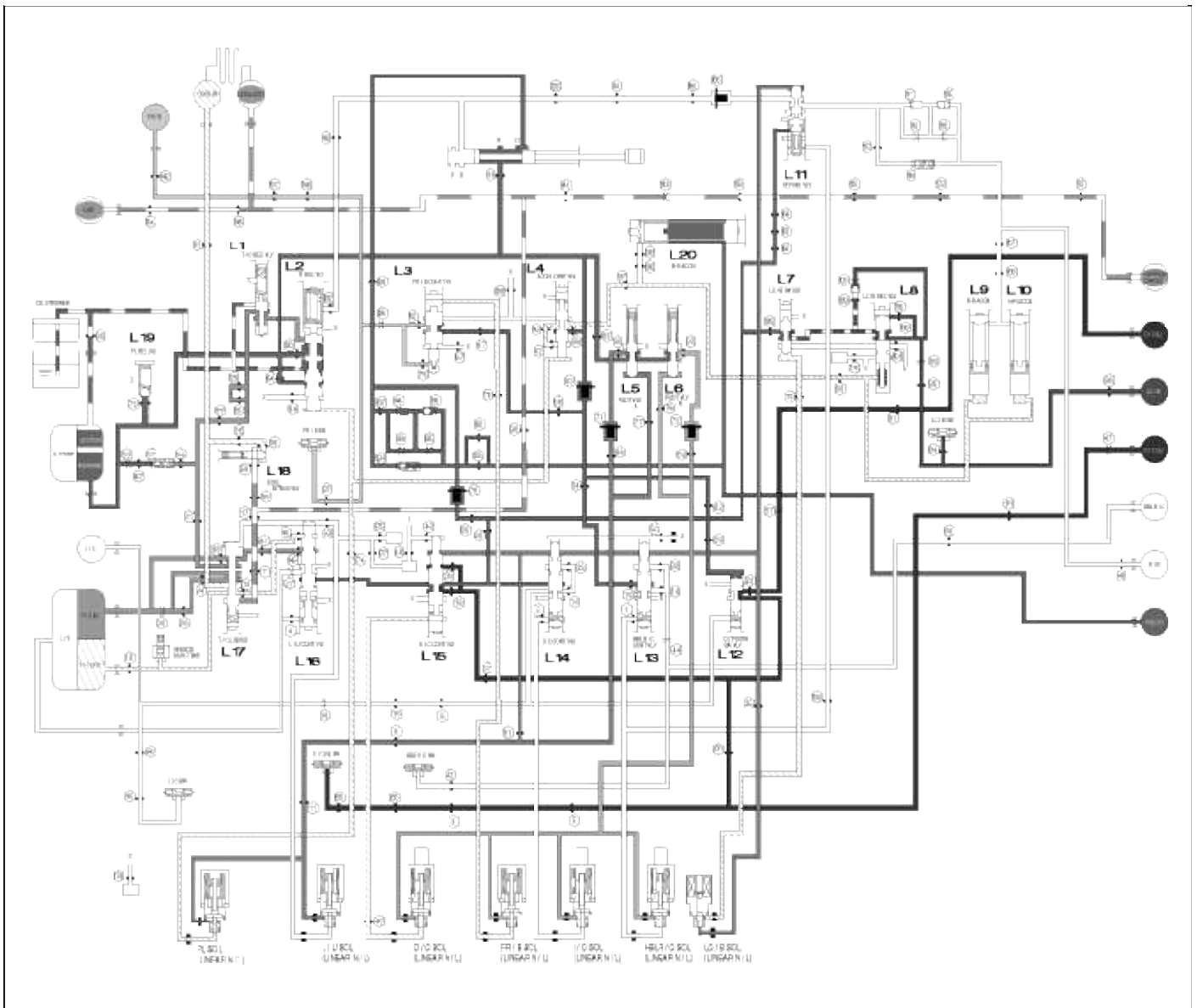


\* Refer to body valves for L(number) valve name.

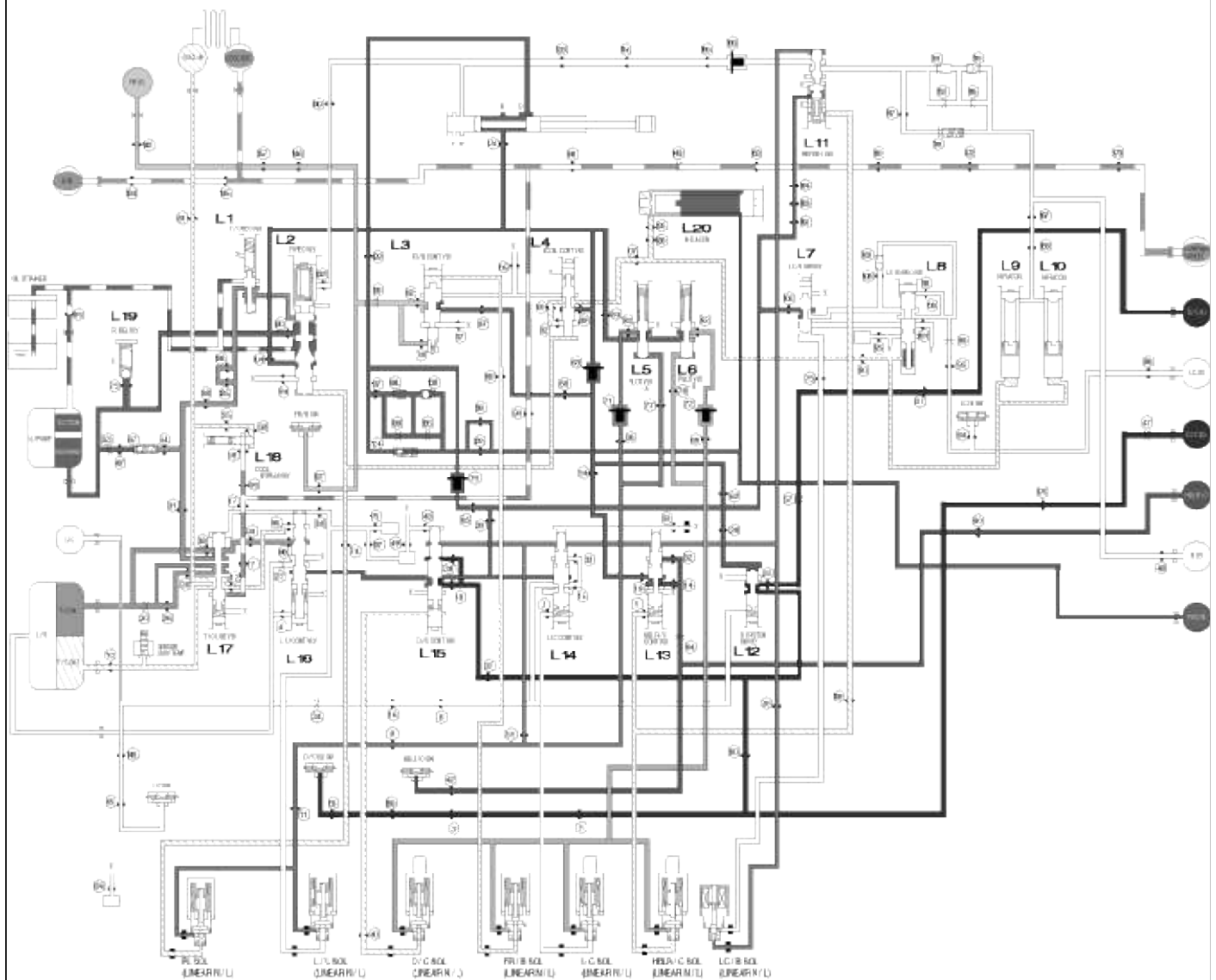
1st gear



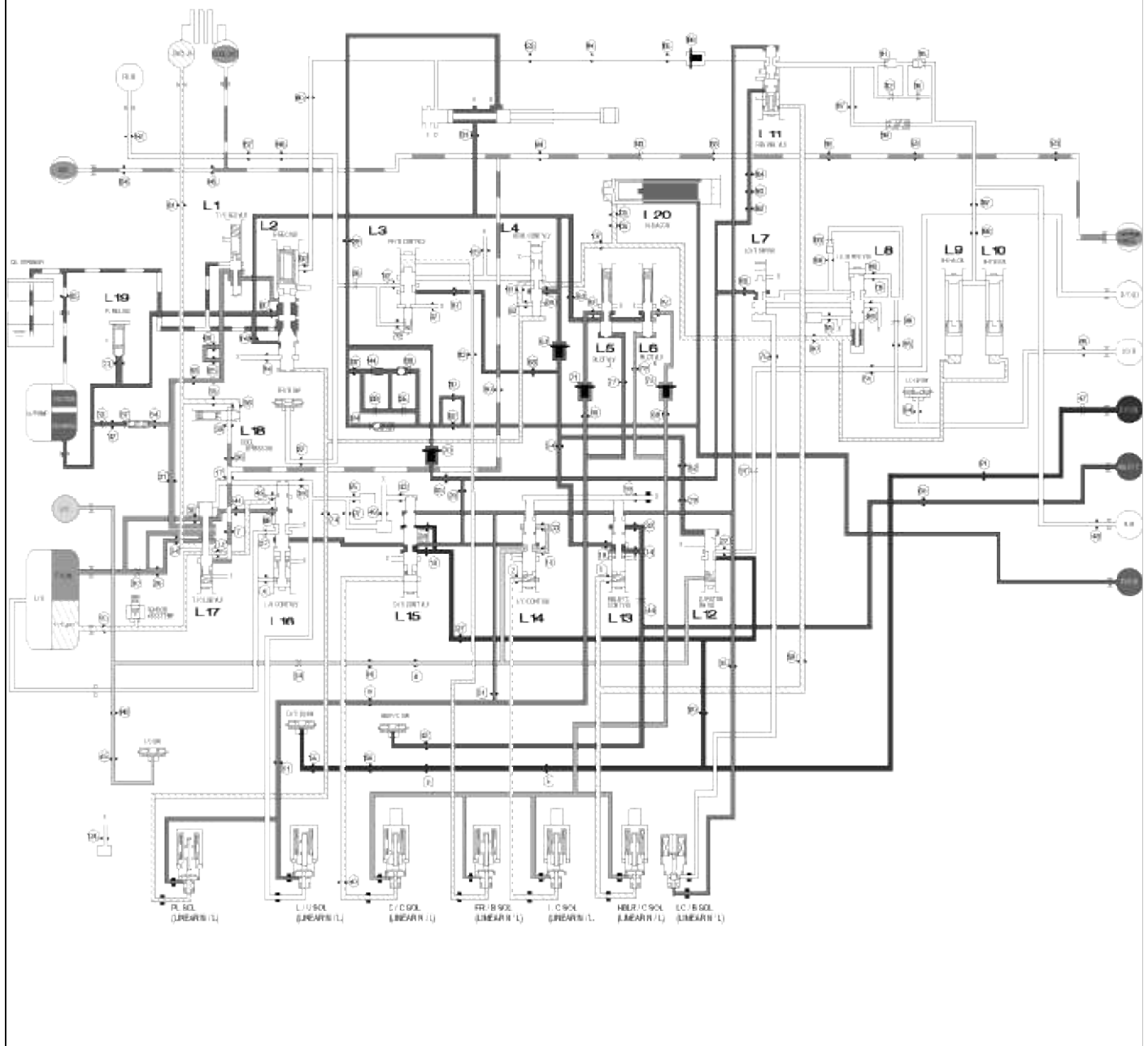
2nd gear



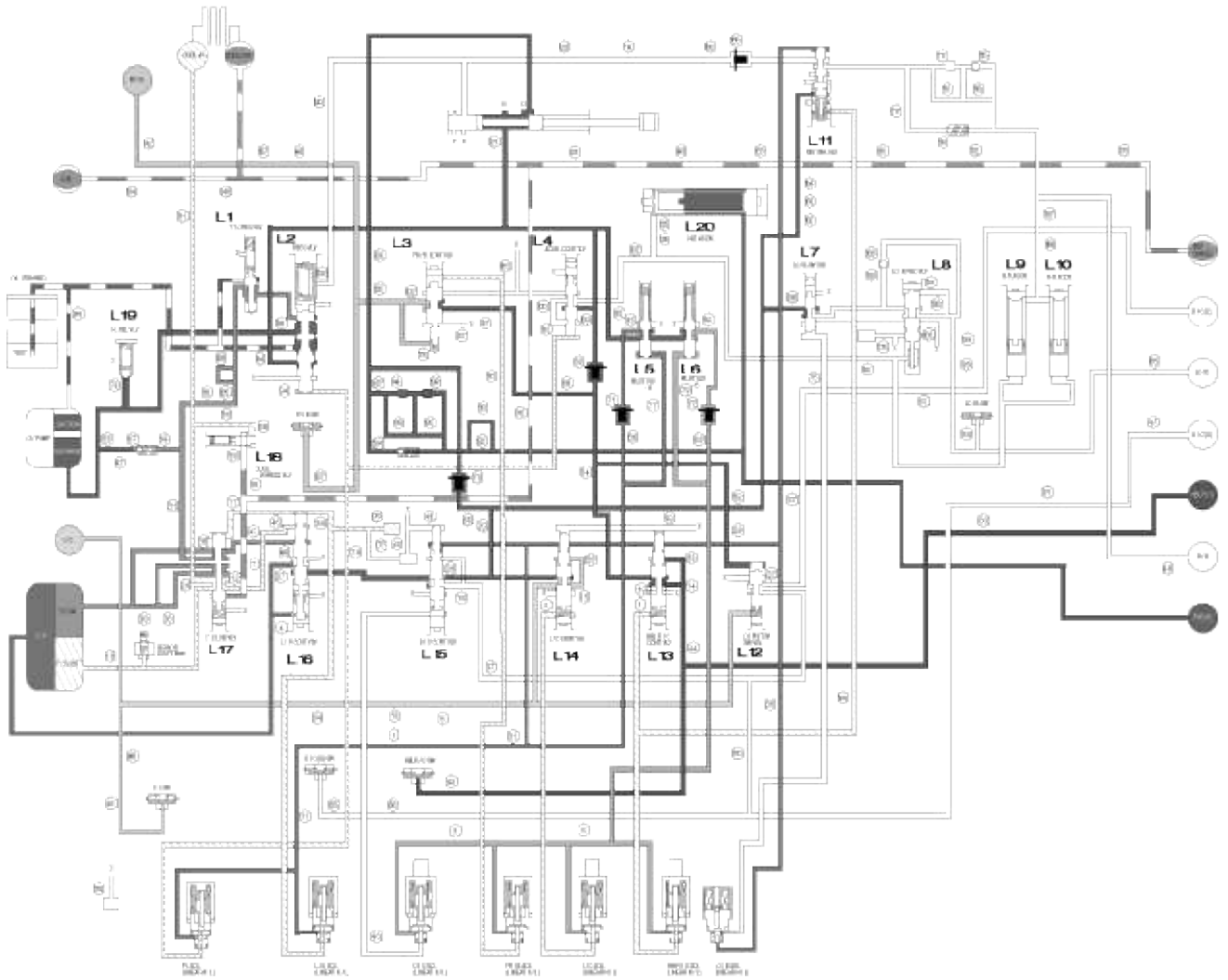
3rd gear



4th gear



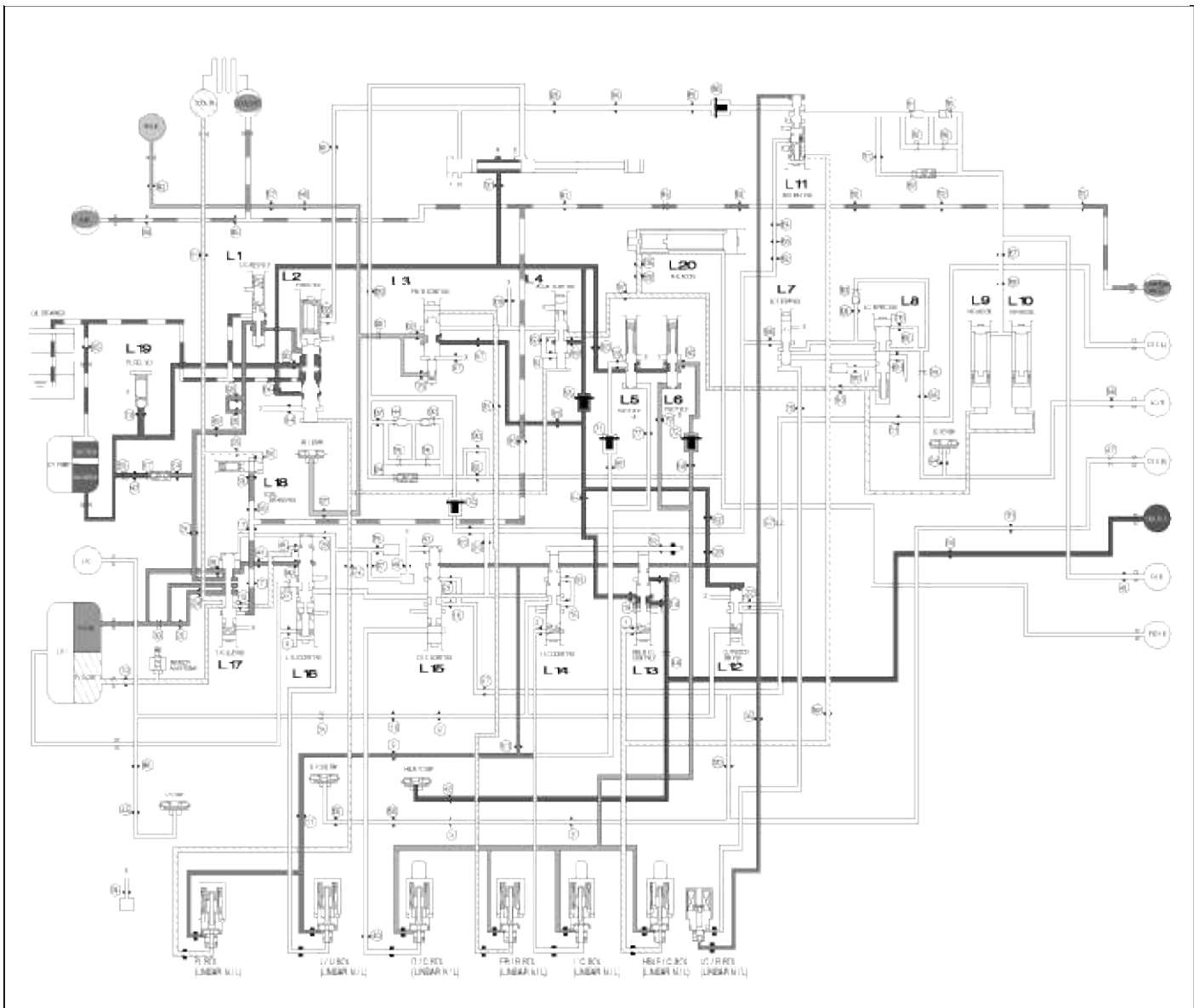
5th gear (lock-up)



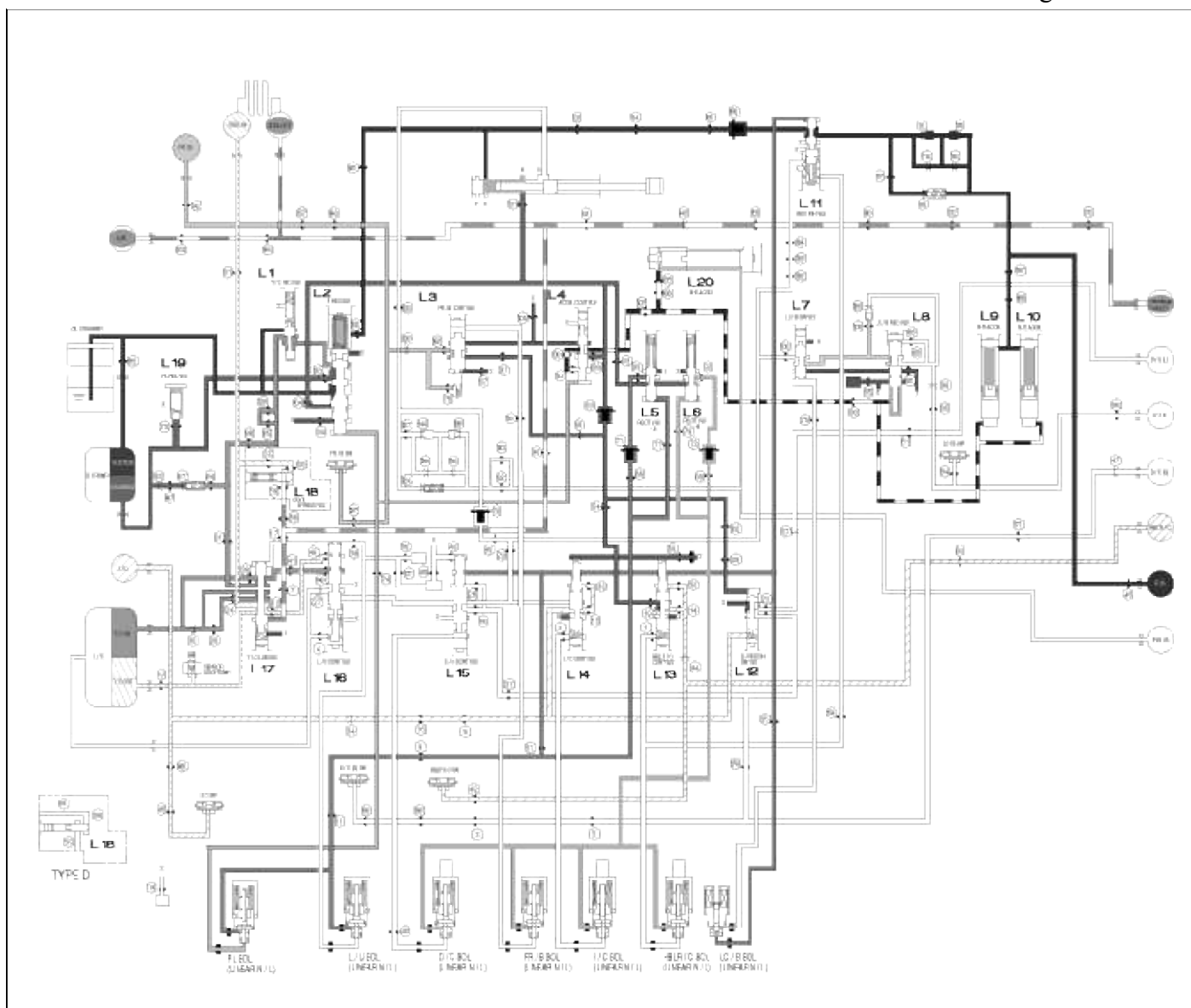
5th gear



P&N range



R range



## Automatic Transaxle System > Automatic Transaxle System > Description and Operation

### DESCRIPTION

The A5SR1/2 is a 5-speed, electronically controlled transmission featuring sports mode shifting. The control valve assembly features an integrated electronic control unit.

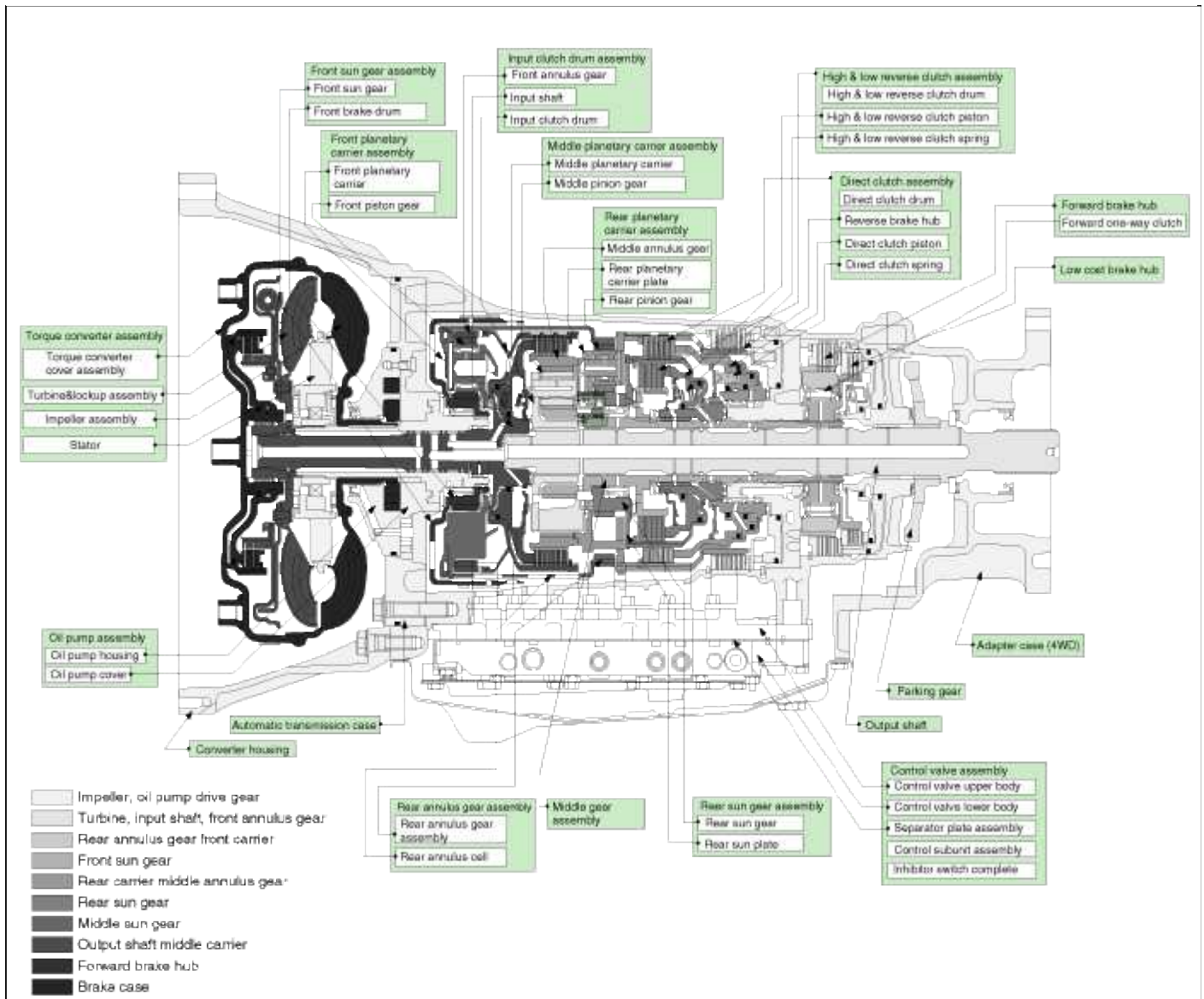
### A5SR1/ 2

Item	Contents
Improved transmission feel	<ul style="list-style-type: none"> <li>- Integrated control over engine and A/T (CAN communication control) system employed</li> <li>- Turbine sensor 1.2 employed</li> <li>- Real time feedback control at all phases applied</li> </ul>
Improved driving	<ul style="list-style-type: none"> <li>- Sports mode function employed</li> <li>- Gear ratio extension</li> </ul>
Improved fuel consumption	<ul style="list-style-type: none"> <li>- Coast lock-up employed</li> <li>- Full range lock-up employed (Larger lock-up zone)</li> <li>- E-flow torque converter employed (Improved driving efficiency)</li> <li>- Small transmission power train employed</li> </ul>
Improved safety	<ul style="list-style-type: none"> <li>- Transmission lock apparatus (P range maintenance apparatus affixed) employed</li> </ul>
Improved maintenance	<ul style="list-style-type: none"> <li>- Electronic system diagnosis tester (hi-scan) counterpart</li> </ul>

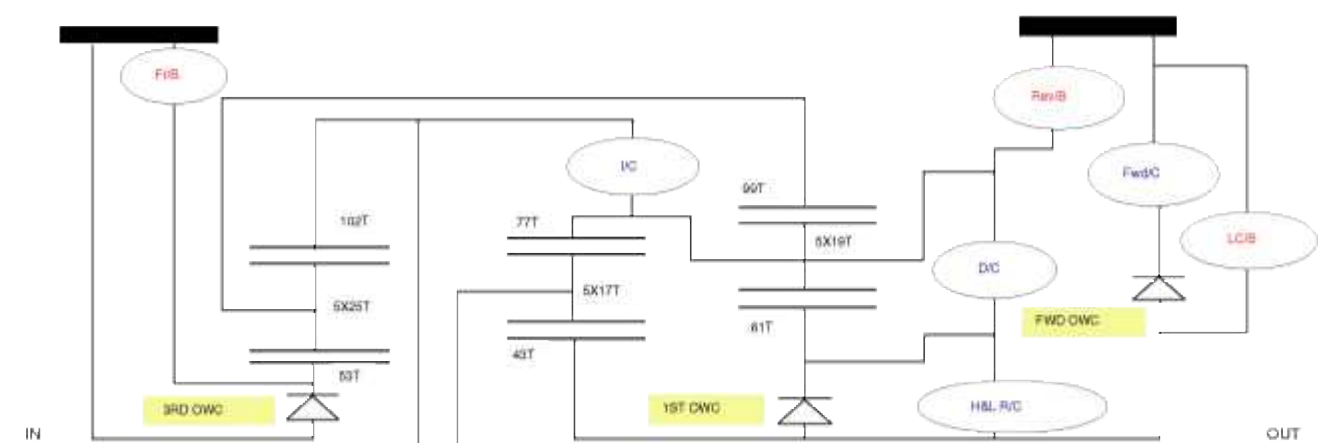
## MAJOR COMPONENTS AND THEIR FUNCTIONS

Part name	Acronyms	Function
Front brake	F/B	Fastens the front sun gear
Input clutch	I/ C	Engages the input shaft, with the middle annulus gear and the front annulus gear
Direct clutch	D/C	Engages the rear planetary carrier with a rear sun gear
High & low reverse clutch	H&L R/C	Engages the middle sun gear with the rear sun gear
Reverse brake	R/B	Fastens the rear planetary carrier
Forward brake	FWD/B	Fastens the middle sun gear
Low cost brake	LC/B	Fastens the middle sun gear
1st one-way clutch	1st OWC	Allows the rear sun gear to turn freely forward relative to the mid sun gear but fastens it for reverse rotation
Forward one-way clutch	FWD OWC	Allows the mid sun gear to turn freely in the forward direction but fastens it for reverse rotation
3rd one-way clutch	3rd OWC	Allows the front sun gear to turn freely in the forward direction but fastens it for reverse rotation

## COMPONENTS



## OPERATION



Shift Position	I/C	H&L R/C	D/C	Rev/B	Fr/B	LC/B	Fwd/B	Ratio1 OWC	Forward OWC	Ratio 2 OWC	Remarks
P		△			△						Parking position
R		0		0	0			⊙		⊙	Reverse position
N		△			△	△**					Neutral position
D	1st	△*			△		0	⊙	⊙	⊙	Automatic shift 1↔2↔3 ↔4↔5
	2nd		0		△		0		⊙	⊙	
	3rd	0	0		0		△	◇		⊙	
	4th	0	0				△	◇			
	5th	0	0		0		△	◇		◇	
5M	5th	0	0		0		△	◇		◇	Fix to the 5th speed
4M	4th	0	0	0			△	◇			Fix to the 4th speed
3M	3rd	0	0		0		△	◇		⊙	Fix to the 3rd speed
2M	2nd		0		0	0	0		⊙	⊙	Fix to the 2nd speed
1M	1st	0			0	0	0	⊙	⊙	⊙	Fix to the 1st speed

0 : Operates.

⊙ : Operates during progressive acceleration.

◇ : Operates and effects power transmission while coasting.

△ : Line pressure is applied but does not affect power transmission.

△\* : Operates under conditions shown in the high & low reverse clutch operating condition.

△\*\* : Operates under conditions shown in the LC/B operating condition.

Note) Delay control is applied during D(4,3,2,1) ⇒ N shift.

## OPERATING PRINCIPLES OF EACH RANGE

### 1. N range

Since the forward and reverse brakes are released, driving force of input shaft is not transmitted to output shaft.

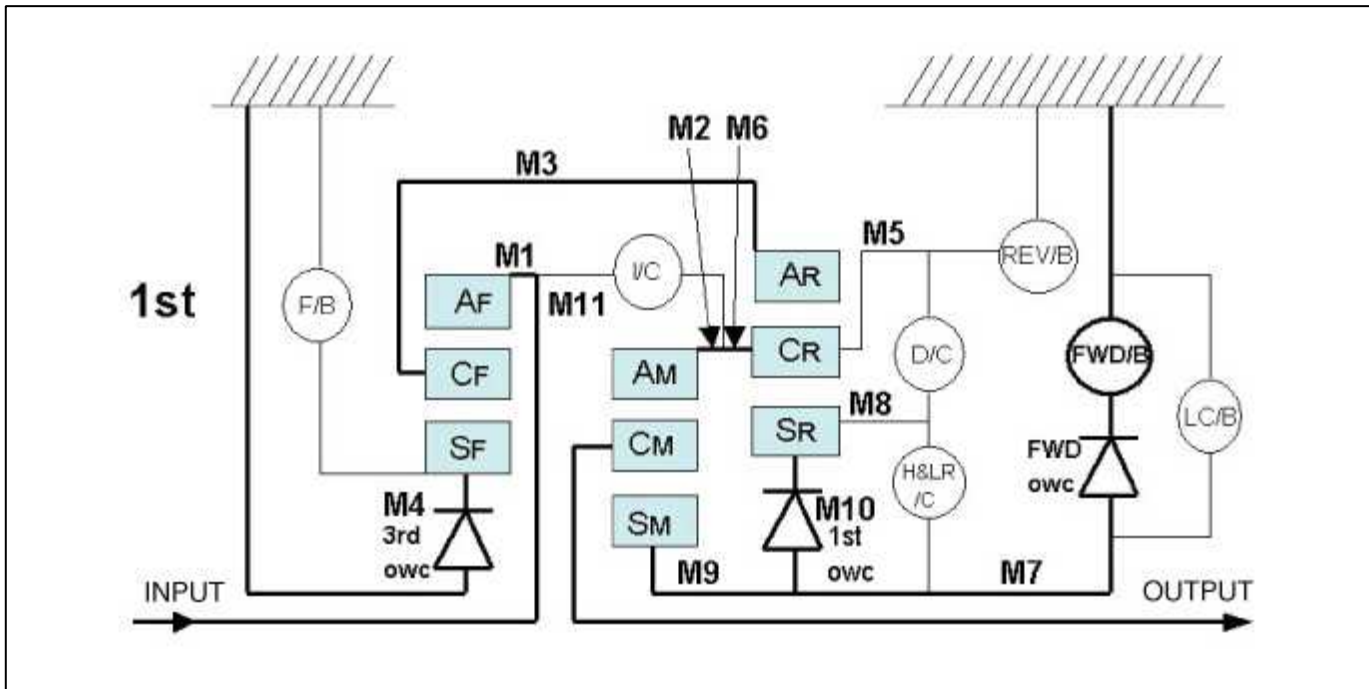
### 2. P range

A. Since the forward and reverse brakes are released, as those in the N range, driving force of input shaft is not transmitted to output shaft.

B. Parking pawl that is linked with select lever parking gear meshes with and fastens output shaft mechanically.

3. D, M2, M3, M4, M5 range 1st speed

- A. Fastens the front brake.
- B. The front brake and the forward one-way clutch regulate reverse rotation of the mid sun gear.
- C. The 1st one-way clutch regulates reverse rotation of the rear sun gear.
- D. The 3rd one-way clutch regulates reverse rotation of the front sun gear.

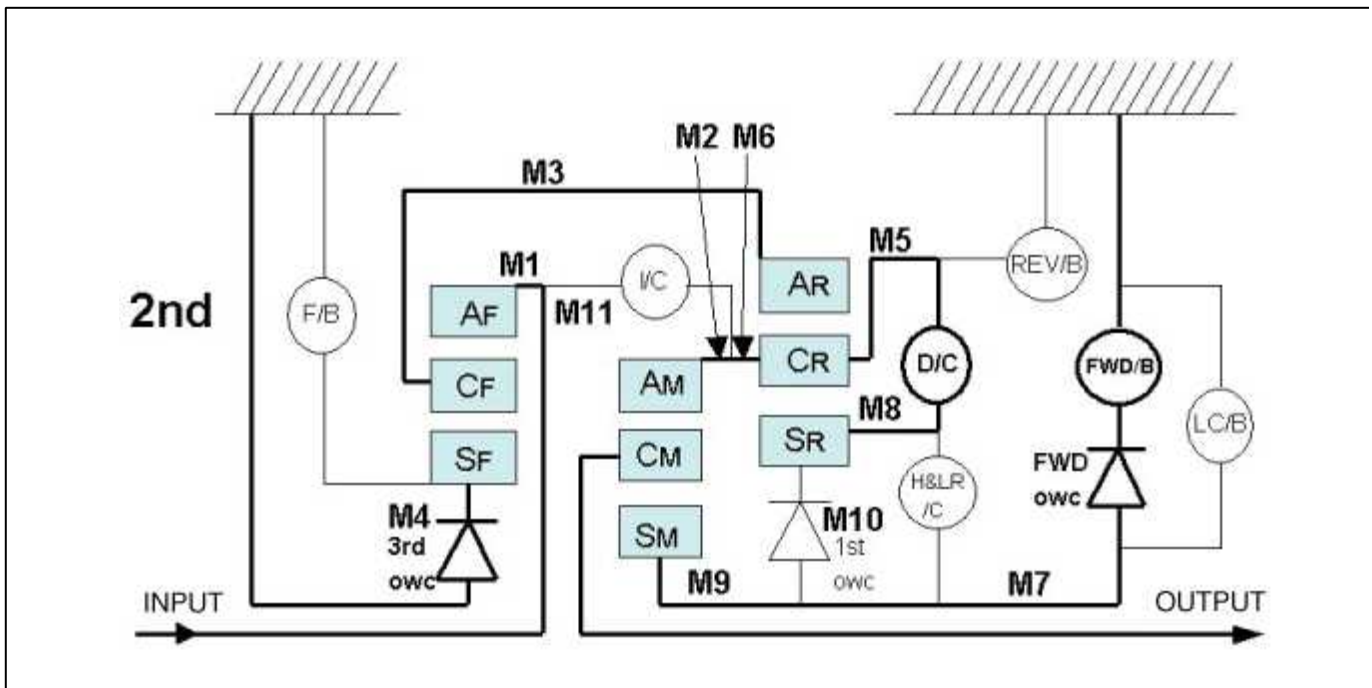


**\* POWER FLOW**

Input shaft→Front internal gear→Front carrier→Rear internal gear→Rear carrier→Middle internal gear→Middle carrier→Output shaft

4. D, M3, M4, M5 range ratio 2nd

- A. Fasten the front brake.
- B. The front brake and the forward one-way clutch regulate reverse rotation of the mid sun gear.
- C. The 3rd one-way clutch regulates reverse rotation of the front sun gear.



The direct clutch is coupled and the rear carrier and the rear sun gear are connected.

**\* POWER FLOW**

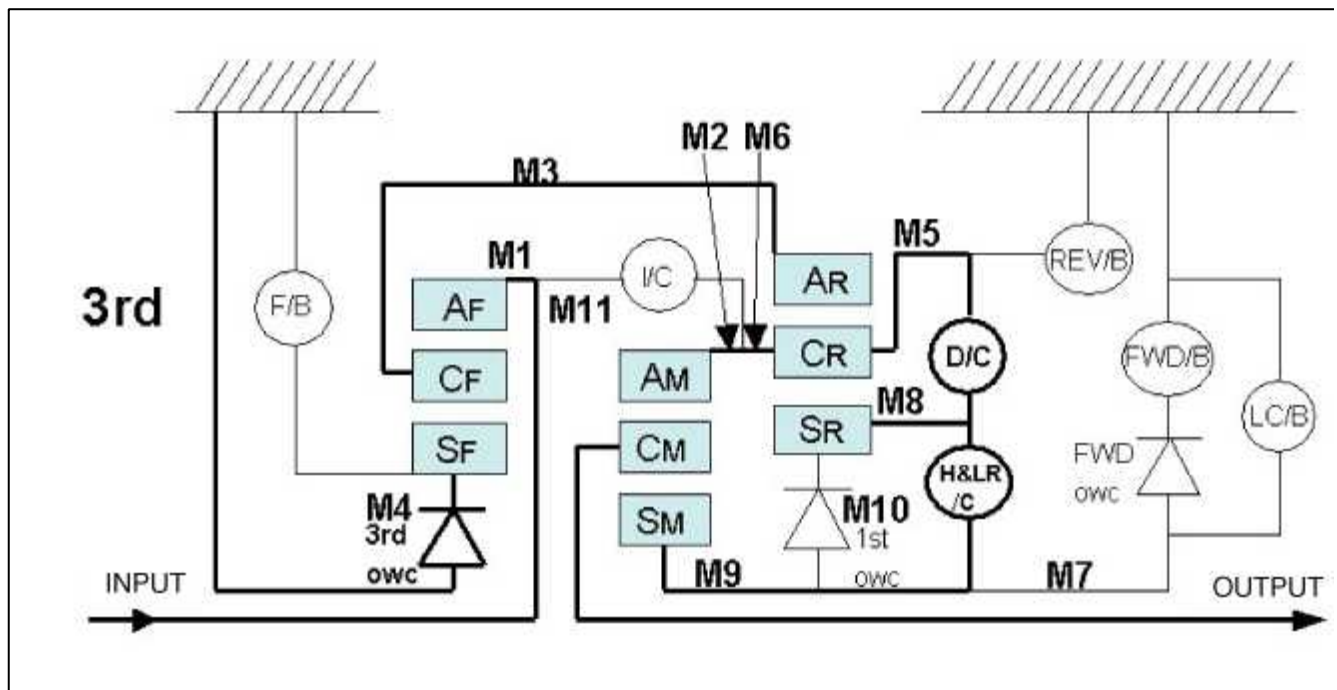
Input shaft→Front internal gear→Front carrier→Rear internal gear→Rear carrier→Rear carrier→Middle internal gear→Middle carrier→Output shaft

gear→Middle carrier→Output shaft

5. D, M3, M4, M5 range 3rd speed

A. Fastens the front brake.

B. The 3rd one-way clutch regulates reverse rotation of the front sun gear.



C. The high & low reverse clutch is coupled and the middle and rear sun gears are connected.

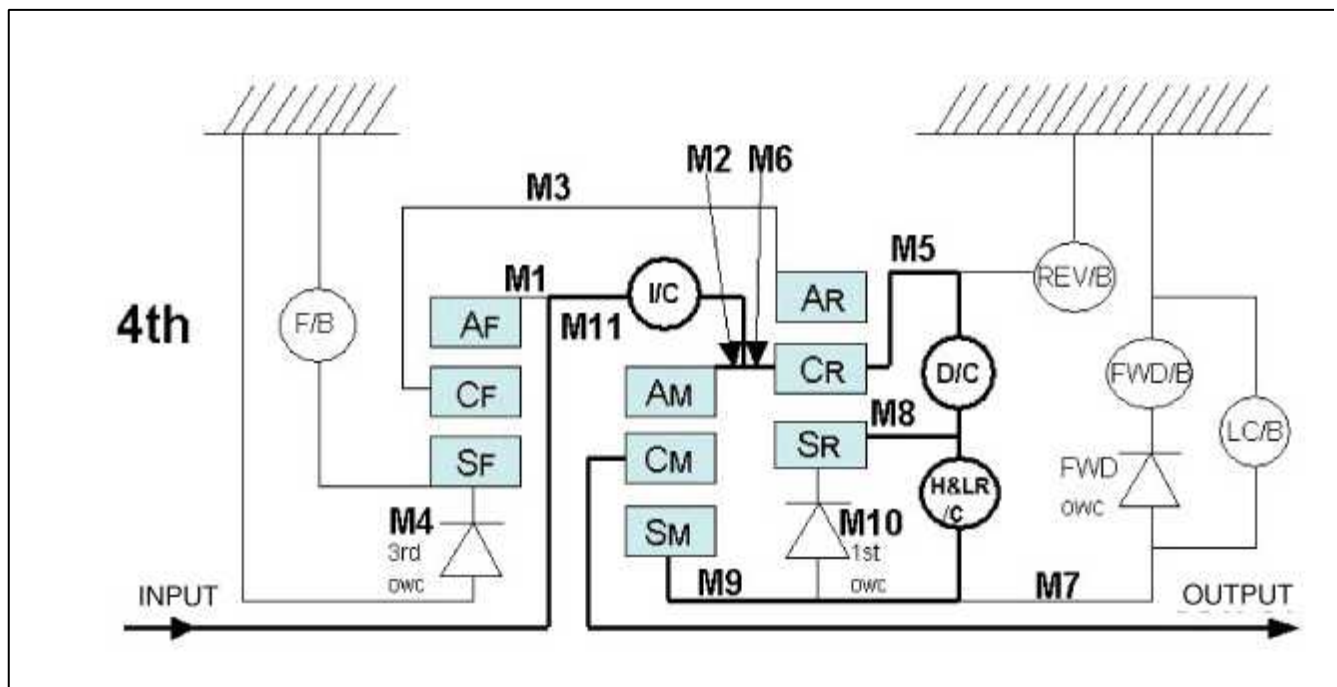
**\* POWER FLOW**

Input shaft→Front internal gear→Front carrier→Rear internal gear→Rear carrier→Rear carrier→Middle internal gear→Middle carrier→Output shaft

6. D, M4, M5 range 4th speed

A. The front brake is released and sun gear turns freely forward.

B. The input clutch is coupled and the front and middle internal gears are connected.



C. Driving force is conveyed to the front internal gear, the middle internal gear, and the rear carrier and the three planetary gears rotate forward as a unit.

**\* POWER FLOW**

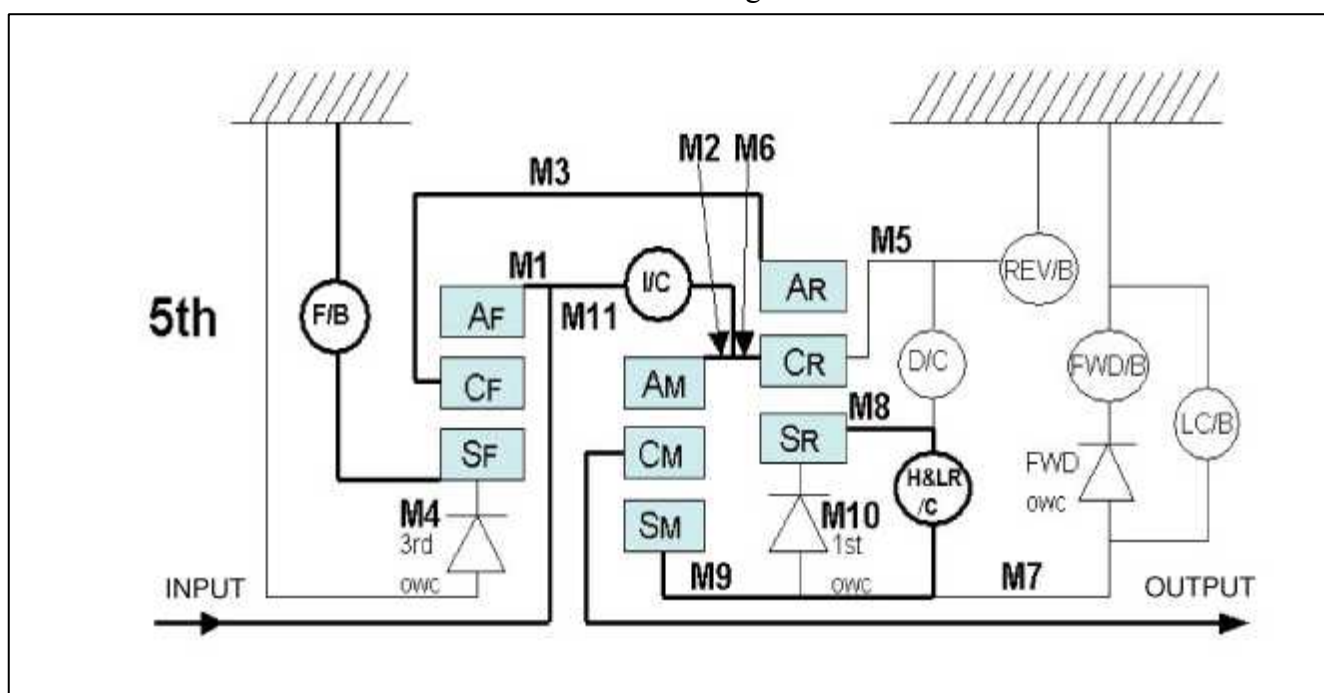
Input shaft→Front internal gear→Front carrier→Rear internal gear→Rear carrier→Middle internal carrier→Mid



carrier→Output shaft

### 7. D, M5 range 5th speed

- The front brake fastens the front sun gear.
- The direct clutch is released and the rear carrier and rear sun gear are disconnected.

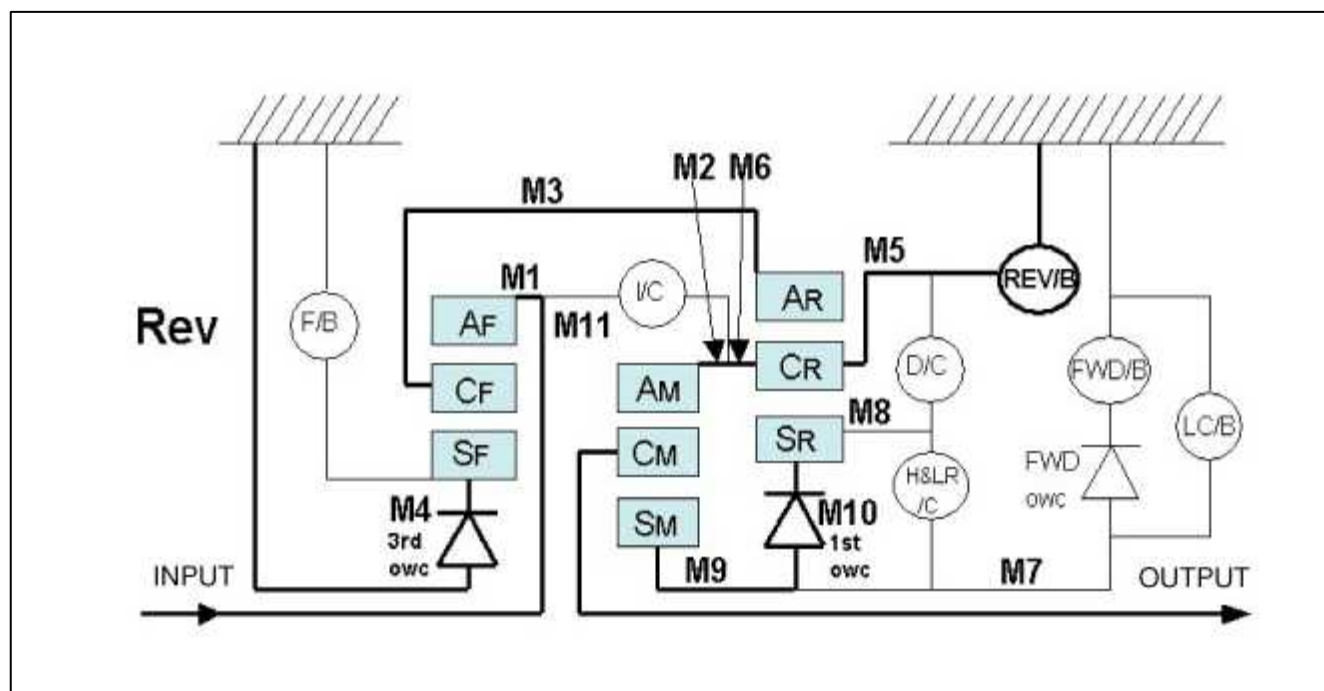


#### \* POWER FLOW

Input shaft→Front internal→Front carrier→Rear internal input shaft→Middle internal→Rear carrier→Rear sun gear→Middle sun carrier→Middle carrier→Output shaft

### 8. R range

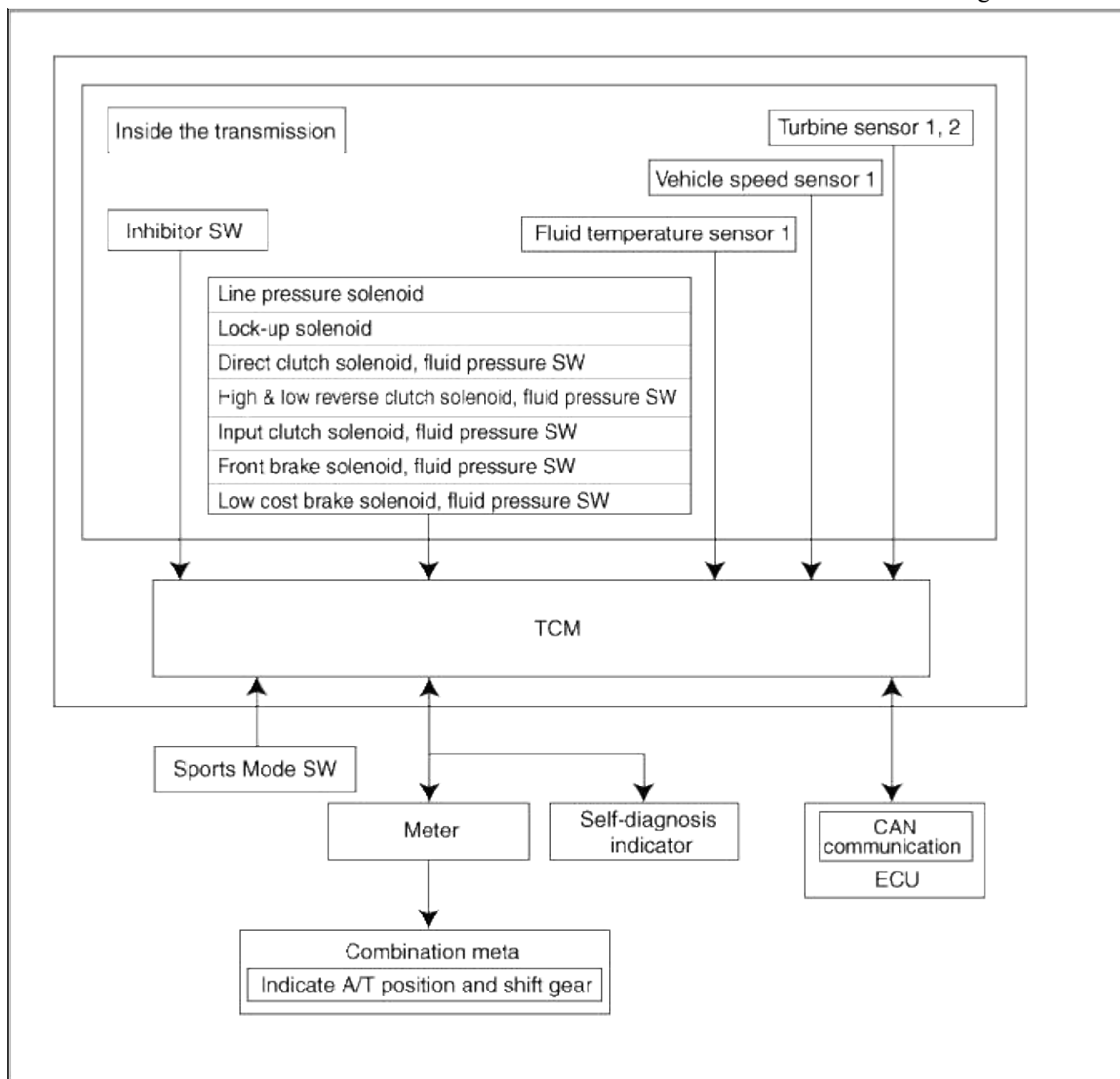
- The front brake fastens the front sun gear.
- The high & low reverse clutch is coupled and the middle and rear sun gears are connected.
- The reverse brake fastens the rear carrier.



#### \* POWER FLOW

Input shaft→Front internal→Front carrier→Rear internal→Rear sun gear→Middle sun gear→Middle carrier→O shaft

CONTROL SYSTEM DIAGRAM



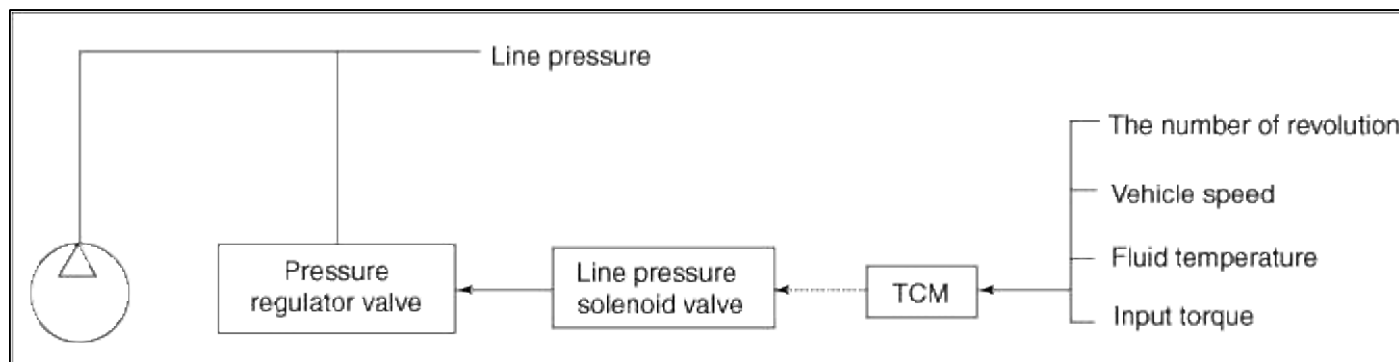
### MAIN COMMUNICATION SIGNAL

Input to ECM(CAN)	Output to ECM(CAN)	Input from external sys.	Output to external sys.
-	-	A/T driving mode SW	Self-diagnosis indicator
Engine torque signal	Output revolution signal	Sports mode SW	Range signal (P, R, N, D)
Engine revolution signal	Turbine sensor signal	Up SW	Range signal
-	Torque reduction request signal	Down SW	Reverse lamp signal
Accelerator opening signal		Stop lamp SW	
		4 x 4 Low signal	

### LINE PRESSURE CONTROL

- If the engine control unit sends the input torque signal equivalent to the engine driving force to the A/T control unit (TCM), the A/T control unit (TCM) controls line pressure solenoid.
- This line pressure solenoid controls the pressure regulator valve as the signal pressure and adjusts the pressure of the operating oil discharged from the oil pump to the line pressure most appropriate to the driving plate.

## LINE PRESSURE SYSTEM DIAGRAM

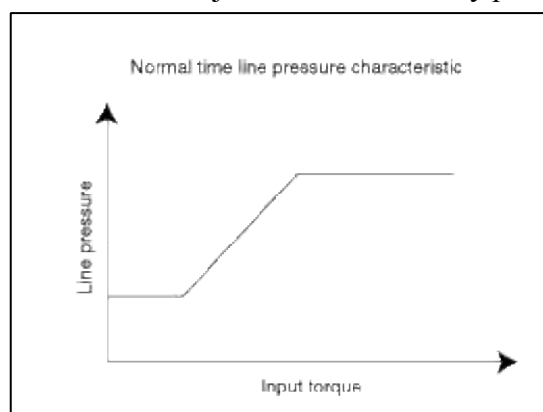


## Line pressure control based on line pressure characteristic pattern of A/T control unit (TCM)

- A/T control unit (TCM) has stored in memory a number of patterns for the optimum line pressure characteristics according to driving conditions.
- In order to obtain the most appropriate line pressure characteristic to meet the current driving state, the TCM controls the line pressure solenoid current valve and thus controls the line pressure.

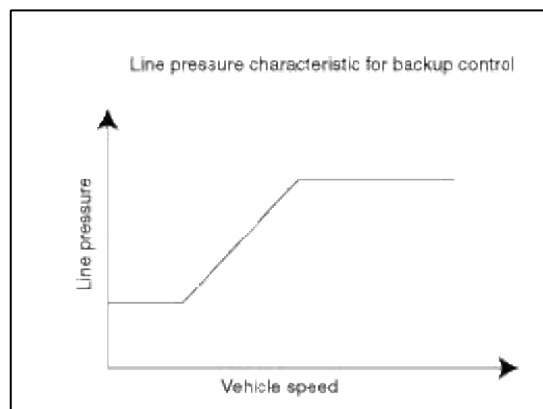
### - Normal line pressure control.

Each clutch is adjusted to the necessary pressure to match the engine drive force.



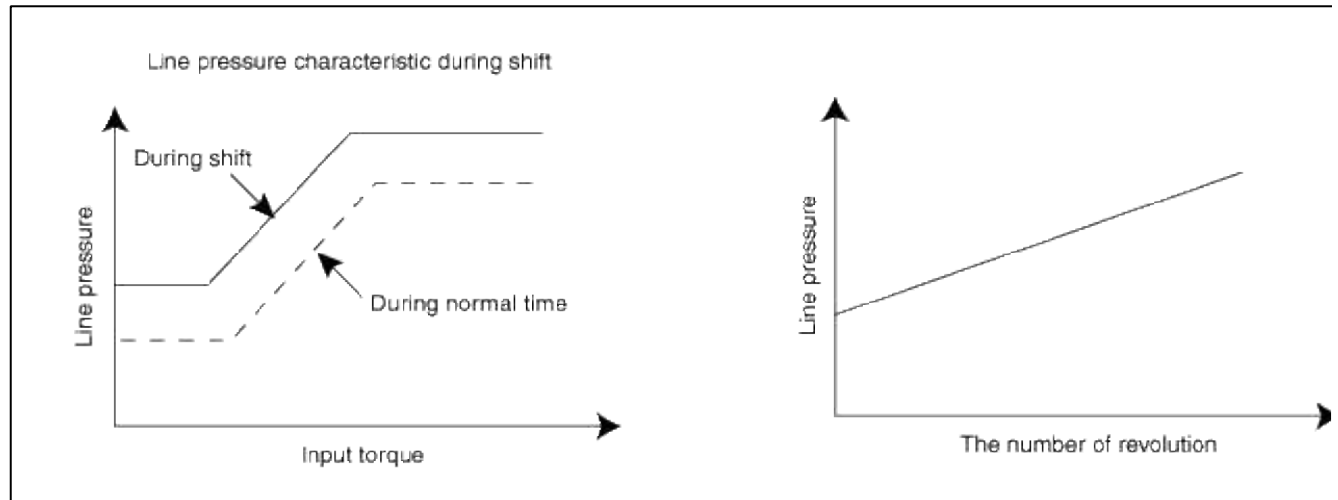
### - Back-up control (Engine brake)

Line pressure according to speed is set during shift down by select operation while driving.



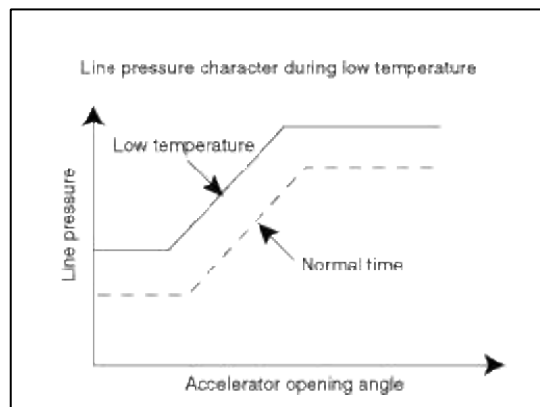
- During shift change

Set to line pressure that is necessary for shift change. Therefore, line pressure characteristic is set according to torque and shift types.



- At low fluid temperature

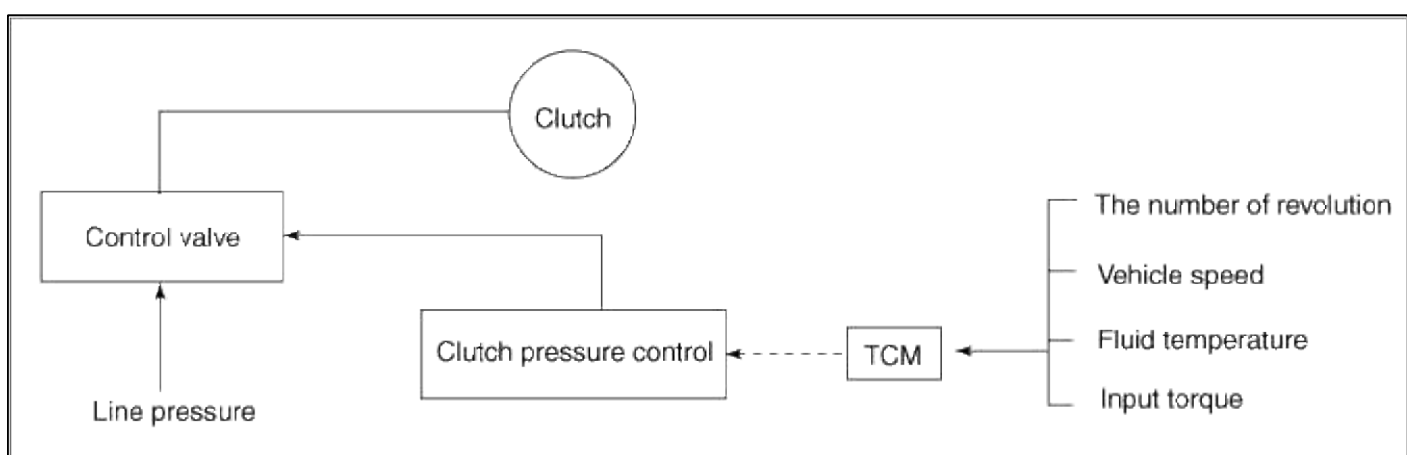
When the A/T fluid temperature drops below the prescribed temperature, in order to speed up the action of each friction element, the line pressure is set higher than the normal line pressure characteristic.



### Shift control

- The clutch pressure control solenoid is controlled by the signals from the switches and sensors. Thus the clutch pressure is adjusted to be appropriate to the engine load state and vehicle driving state. It becomes possible to finely control the clutch hydraulic pressure with high precision and a smoother shift change characteristic is attained.

### SHIFT CONTROL SYSTEM DIAGRAM



**Shift description**

Controls clutches with optimum timing and fluid pressure in response to engine speed, engine torque information, and etc.

**Lock-up control**

Lock-up control is to enhance delivery efficiency by preventing the torque converter from slipping, engaging the lock-up piston into the torque converter.

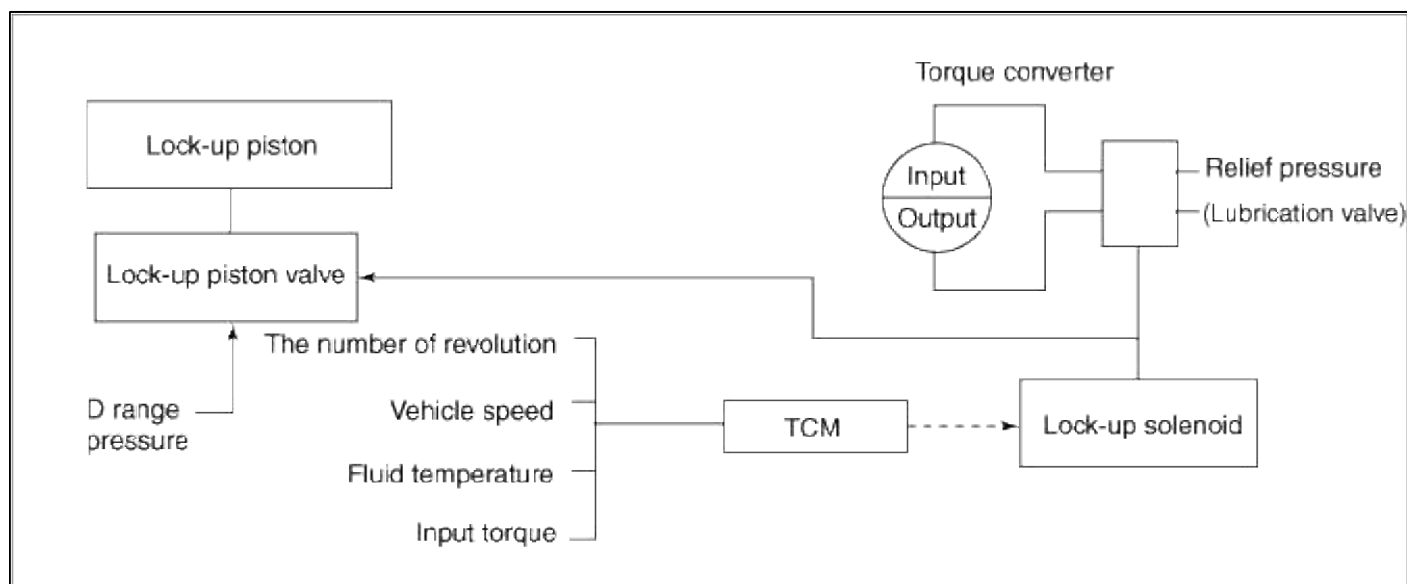
It operates lock-up solenoid control in response to a signal from A/T control unit (TCM) and lock-up control valve behavior control, engages or releases the lock up piston of the torque converter.

**LOCK-UP OPERATING CONDITION TABLE**

Select lever	D range			Sports mode	
Gear position	5	4	3	5	4
Lock-up	○	-	-	○	○
Slip lock-up	○	○	-	-	-

**Lock-up control valve control**

- In the lock-up control valve, there is operating fluid pressure circuit linked into the lock-up piston and lock-up solenoid operates valve shift in response to a signal from the A/T control unit.
- Operating fluid pressure circuit that is applied to the lock-up piston chamber is controlled with the release or apply sides.

**LOCK-UP CONTROL SYSTEM DIAGRAM**

**Lock-up released**

- In the lock-up control valve, there is operating fluid pressure circuit connected into the lock-up piston and lock-up solenoid operates valve shift in response to a signal from the A/T control unit.

Therefore, the lock-up piston is not coupled.

**Lock-up applied**

- During the lock-up applied status, lock-up apply pressure is generated having the lock-up control valve to L/U by the lock-up solenoid.

Therefore, press the lock-up piston to be coupled.

**Smooth lock-up control**

- A/T control unit (TCM) controls current value that is output to the lock-up solenoid when shifting lock-up applied state from lock-up released state.

Therefore the lock-up clutch is temporarily set to half-clutched state when shifting the lock-up applied state to reduce the shock.

**Half-clutched state**

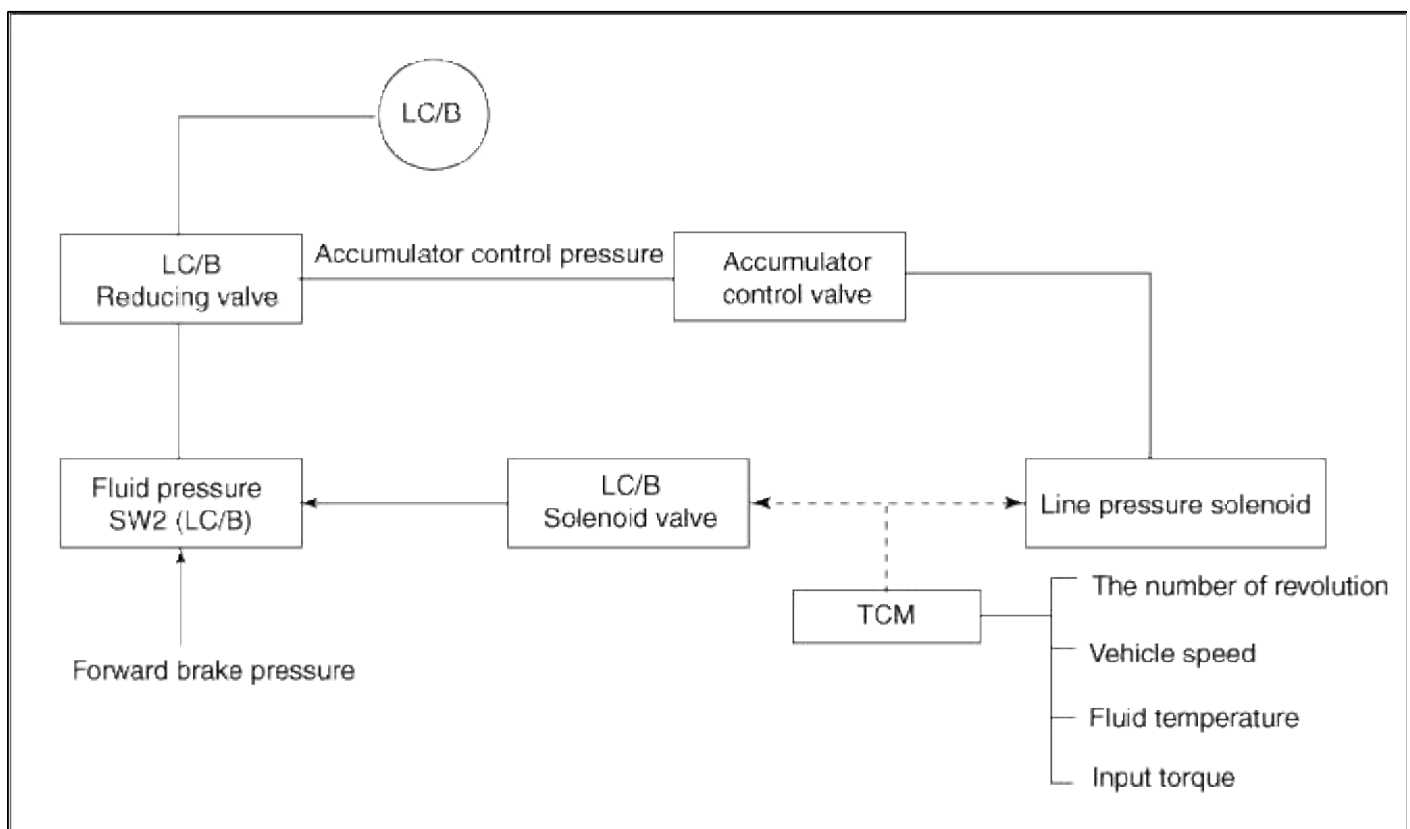
- Changes current value that is output to the lock-up solenoid from A/T control unit (TCM) to gradually increase lock-up solenoid pressure.

In this way, the lock up apply pressure gradually rises and while the lock-up piston is put into half-clutched status, the lock-up piston operating pressure is increased and the coupling is completed smoothly.

**Engine brake control**

- The forward one-way clutch delivers driving force from the engine to the rear wheel but reverse driving from the wheel drive is not delivered since the one-way clutch is idling.

Therefore low coast brake solenoid is operated to prevent the forward one-way clutch from idling so that the engine brake is operated in the same as before.

**ENGINE BRAKE CONTROL SYSTEM DIAGRAM**

- The operation of the low coast brake solenoid switches the low coast brake switch valve and controls the coupling and releasing of the low coast brake.  
The low coast brake reducing valve controls the low coast brake coupling force.

## CONTROL VALVE

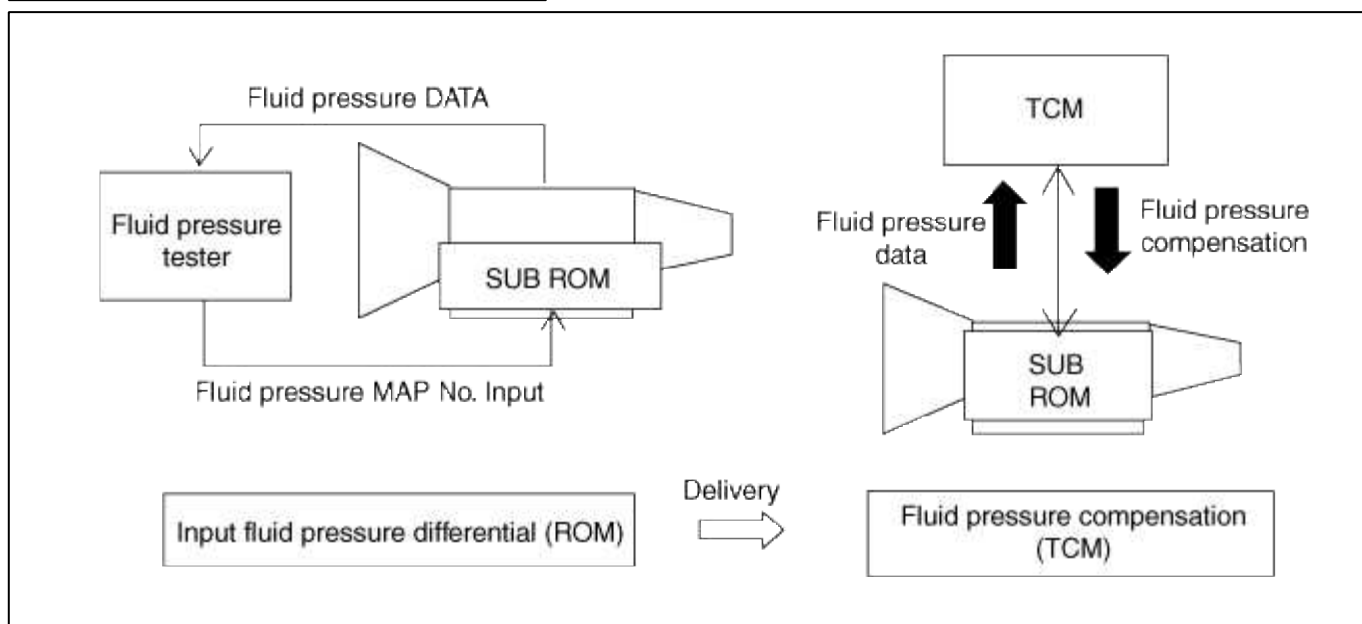
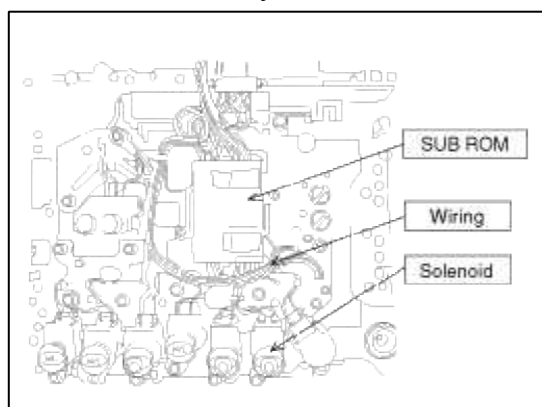
### Control valve functions

Valve name	Function
Torque converter regulator valve	Regulates line pressure to the optimum pressure (torque converter operating pressure) to prevent pressure applied to the torque converter from being excessive.
Pressure regulator valve Pressure regulator plug Pressure regulator sleeve	Regulates oil pump discharge pressure to the optimum pressure (line pressure) in response to the driving conditions.
Front brake control valve	Regulates line pressure to the optimum pressure (front brake pressure) to be applied to the front brake during the front brake apply.
Accumulator control valve	Regulates pressure applied to the accumulator piston, and the low coast reducing valve (accumulator control pressure) in response to the driving conditions (regulates clutch pressure at 1st, 2nd, 3rd, 5th gears).
Pilot valve A	Regulates line pressure to the regular pressure required by line pressure control, shift control, and lock-up control (pilot pressure).
Pilot valve B	Regulates line pressure to the regular pressure required by shift control (pilot pressure).
Low coast brake switching valve	Provides the low coast brake reducing valve with line pressure during engine brake operation.
Low coast brake reducing valve	Regulates line pressure to the optimum pressure to be applied to the low coast brake when the low coast brake is coupled.
N-R accumulator	Produces the stabilizing pressure for when N-R is selected.
Direct clutch piston switching valve	Operates in 4th gear and switches the direct clutch coupling capacity.
High&low reverse clutch control valve	Regulates line pressure to the optimum pressure (high&low reverse clutch pressure) to be applied to the high&low reverse clutch when the high&low reverse clutch is coupled (regulates clutch pressure in 1st, 3rd, 4th, 5th gears).
Input clutch control valve	Regulates line pressure to the optimum pressure (input clutch pressure) to be applied to the input clutch when the input clutch is coupled (regulates clutch pressure in 4th, 5th gears).
Direct clutch control valve	Regulates line pressure to the optimum pressure (direct clutch pressure) to be applied to the direct clutch when the direct clutch is coupled (regulates clutch pressure in 2nd, 3rd, 4th gears).
Lock-up control valve Lock-up control plug Lock-up control sleeve	Switches lock-up to operating or released. Also, by performing the lock-up operation transiently, lock-up smoothly.
Torque converter lubrication valve	Operates to switch torque converter, cooling, and oil path of lubrication system during lock-up.

Cool bypass valve	Allows excess oil to by pass cooler circuit without being fed into it.
Line pressure relief valve	Discharges excess oil from line pressure circuit.
N-D accumulator	Produces the stabilizing pressure for when N-D is selected.
Manual valve	Delivers line pressure to each circuit in response to each select position. Circuit to which line pressure is not sent drain.

### SUB ROM unit

1. Installing location: The valve body upper part
2. Function: To obtain A/T fluid pressure stability by compensating for solenoid&valve body unit fluid pressure differential.
3. Principle: Install additional ROM onto valve body of automatic transmission and input fluid pressure differential of solenoid & valve body so that TCM reads the input data to perform fluid pressure compensation.



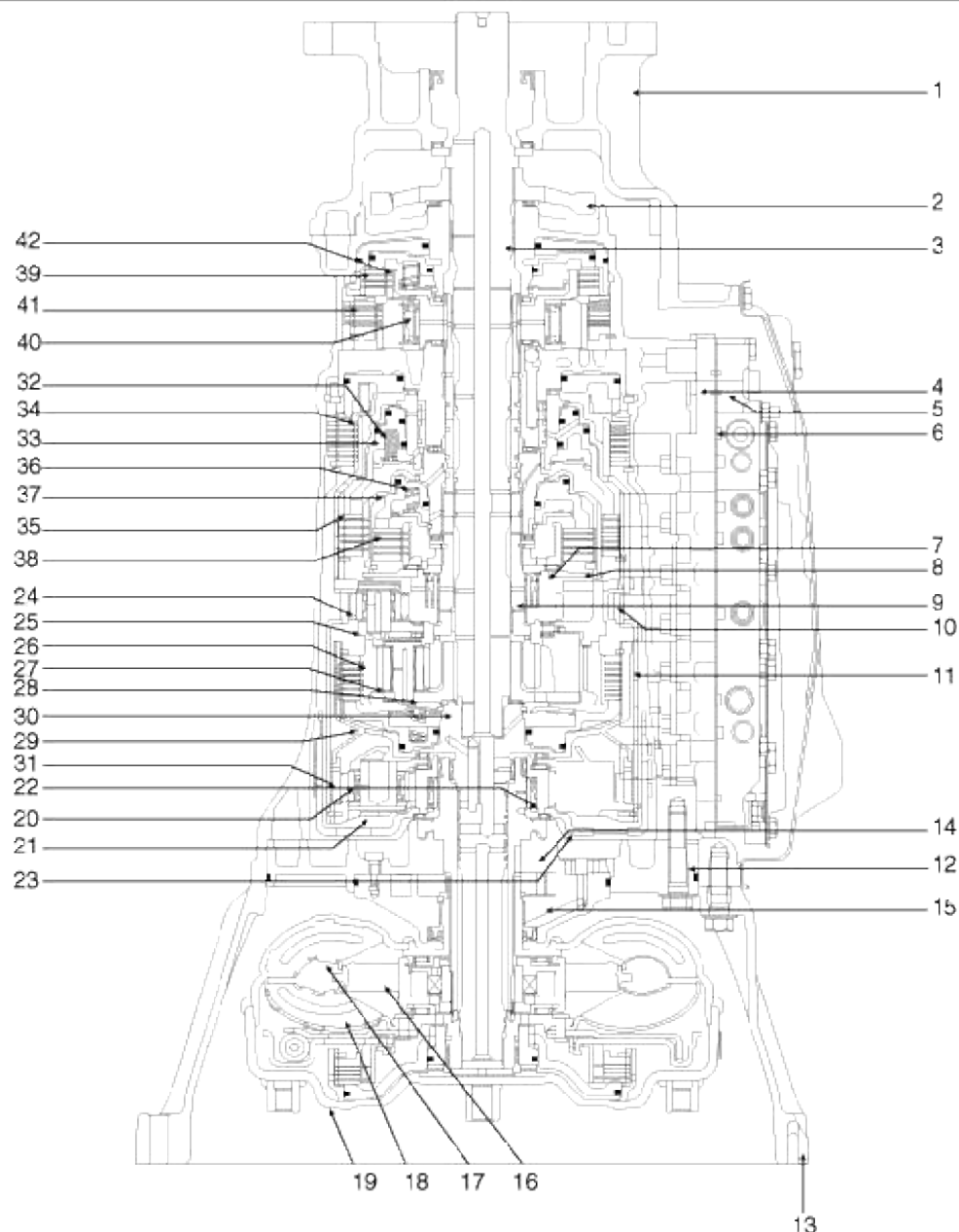


#### 4. Maintenance

- (1) When replacing with a new TCM in the vehicle
  - A. TCM automatically reads SUB ROM DATA during I.G ON. At this time, shift range valve is off for about 2.5 second.
- (2) When replacing A/T (regardless of new or old ones) in the vehicle
  - A. Must erase SUB ROM DATA stored in TCM.
  - B. With the ignition ON (engine OFF), maintain 50% throttle opening in R range while using the TCU SUB ROM RESET mode on the scan tool.
  - C. TCM reads SUB ROM DATA from a new A/T upon I.G ON again after I.G OFF.
- (3) Moving TCM from vehicle A to another vehicle B
  - A. Perform the same way as in 2) above.

**Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Components and Components Location**

#### COMPONENTS

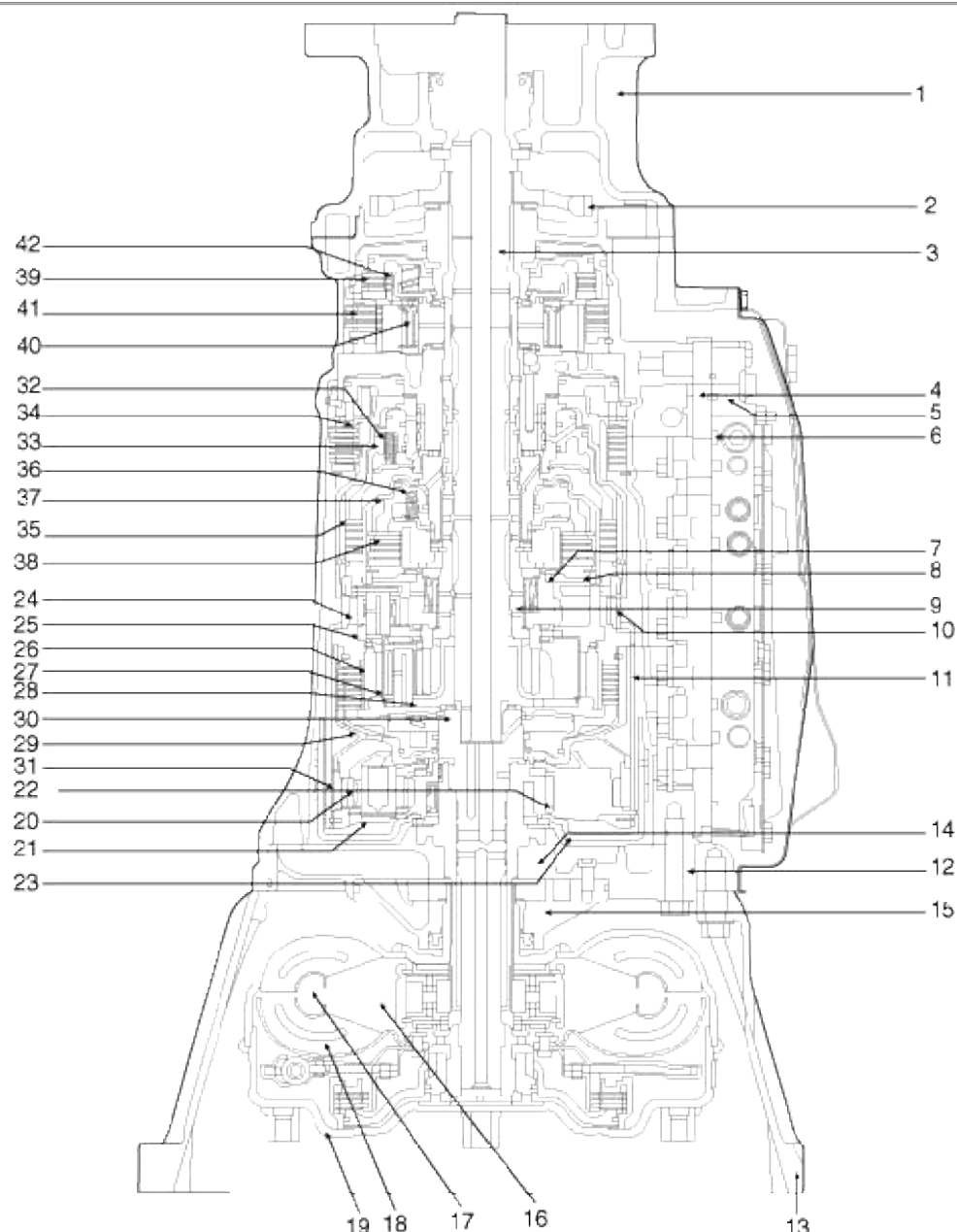
**[A5SR1]**

1. Adapter case (4WD)
2. Parking gear
3. Output shaft
4. Control valve upper body
5. Control valve lower body
6. Separator plate assembly
7. Rear sun gear
8. Rear sun plate
9. Middle sun gear assembly
10. Rear annulus gear assembly
11. Rear annulus cell
12. Automatic transmission case
13. Converter housing
14. Oil pump cover

15. Oil pump housing
16. Stator
17. Impeller assembly
18. Turbine & lockup assembly
19. Torque converter cover assembly
20. Front pinion gear
21. Front planetary carrier
22. Front sun gear
23. Front brake drum
24. Rear pinion gear
25. Rear planetary carrier plate
26. Middle annulus gear
27. Middle pinion gear
28. Middle planetary carrier

29. Input clutch drum
30. Input shaft
31. Front annulus gear
32. Direct clutch return spring
33. Direct clutch piston
34. Reverse brake hub
35. Direct clutch assembly
36. High & low reverse clutch return spring
37. High & low reverse clutch piston
38. High & low reverse clutch assembly
39. Low coast brake clutch assembly
40. Forward one-way clutch
41. Forward brake clutch assembly
42. Low coast brake hub

[A5SR2]

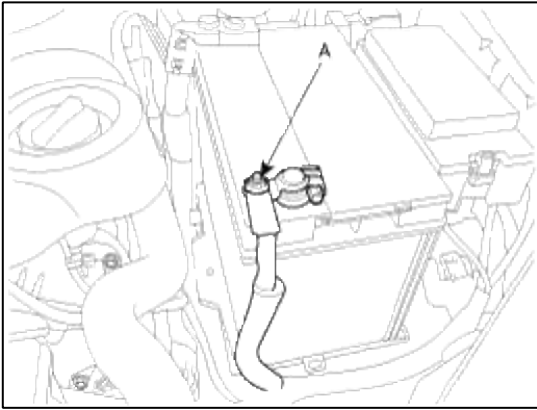


1. Adapter case (4WD)	15. Oil pump housing	29. Input clutch drum
2. Parking gear	16. Stator	30. Input shaft
3. Output shaft	17. Impeller assembly	31. Front annulus gear
4. Control valve upper body	18. Turbine & lockup assembly	32. Direct clutch return spring
5. Control valve lower body	19. Torque converter cover assembly	33. Direct clutch piston
6. Separator plate assembly	20. Front pinion gear	34. Reverse brake hub
7. Rear sun gear	21. Front planetary carrier	35. Direct clutch assembly
8. Rear sun plate	22. Front sun gear	36. High & low reverse clutch return spring
9. Middle sun gear assembly	23. Front brake drum	37. High & low reverse clutch piston
10. Rear annulus gear assembly	24. Rear pinion gear	38. High & low reverse clutch assembly
11. Rear annulus cell	25. Rear planetary carrier plate	39. Low coast brake clutch assembly
12. Automatic transmission case	26. Middle annulus gear	40. Forward one-way clutch
13. Converter housing	27. Middle pinion gear	41. Forward brake clutch assembly
14. Oil pump cover	28. Middle planetary carrier	42. Low coast brake hub

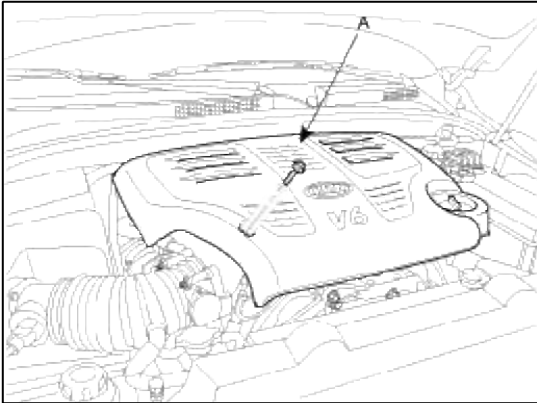
## Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Repair procedures

### REMOVAL

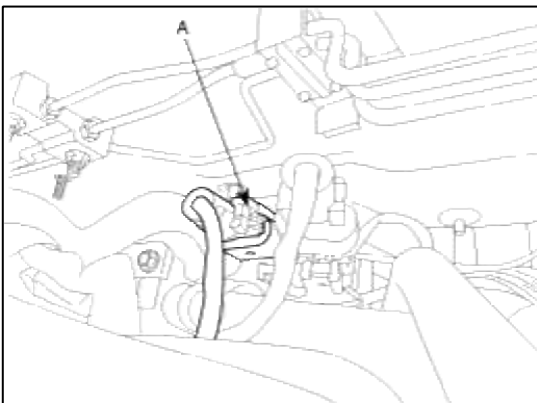
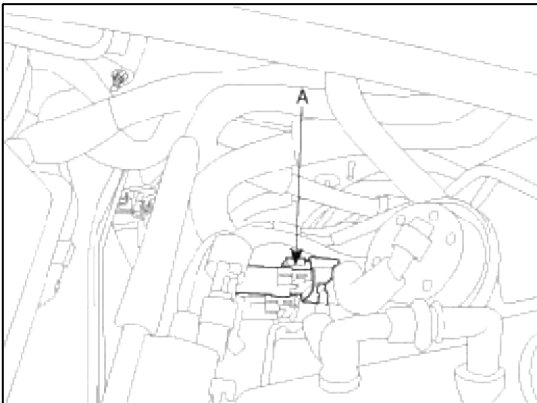
1. Remove the battery (-) terminal(A).



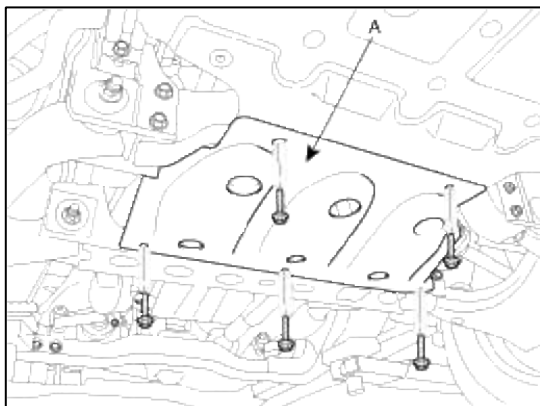
2. Remove the engine cover(A).



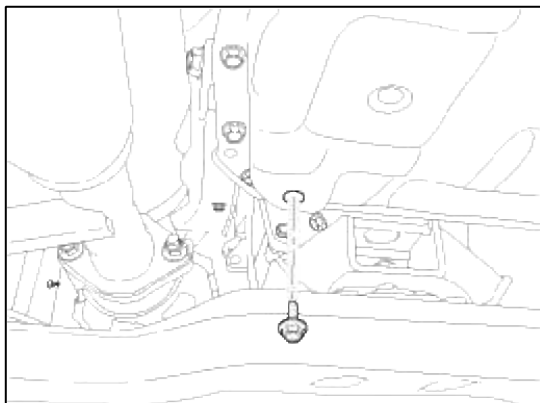
3. Remove the O2 sensor connectors(A).



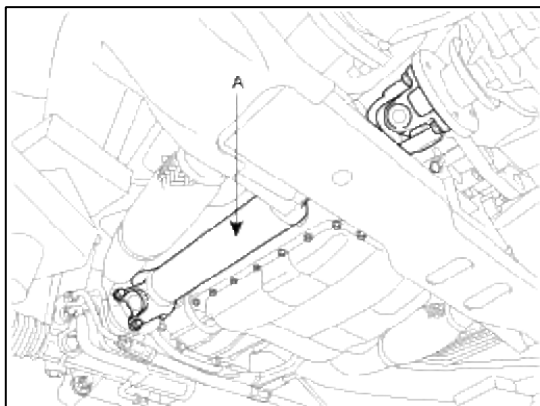
4. Remove the under cover(A).



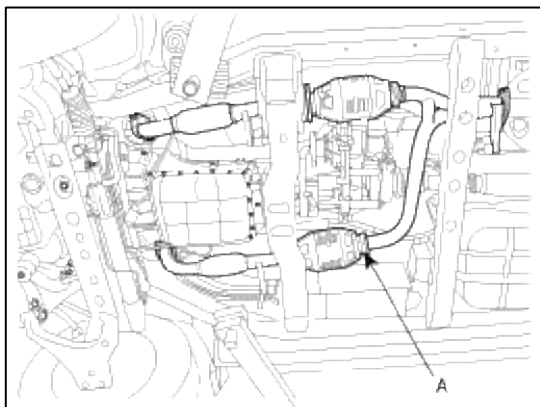
5. Drain the automatic transmission fluid.



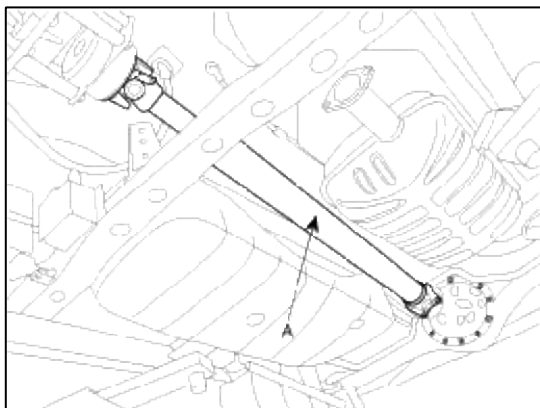
6. Remove the front propeller shaft(A). (4WD)



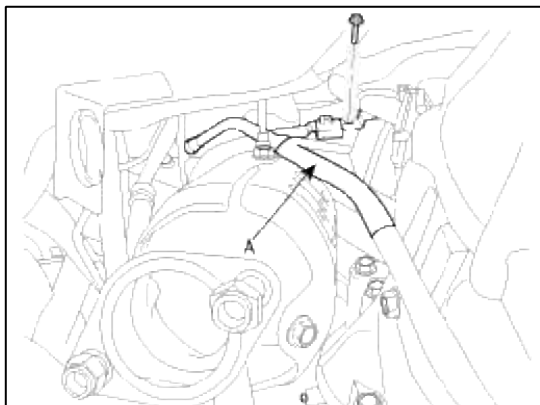
7. Remove the front muffler(A) and the heat protector.



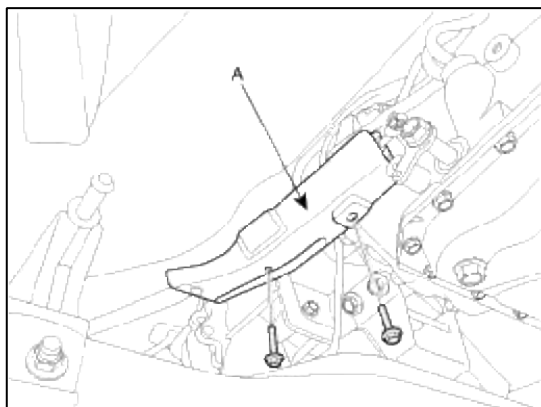
8. Remove the rear propeller shaft(A).



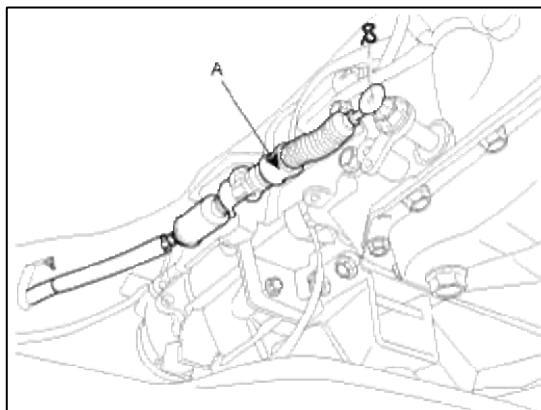
9. Remove the transmission oil level gauge(A).



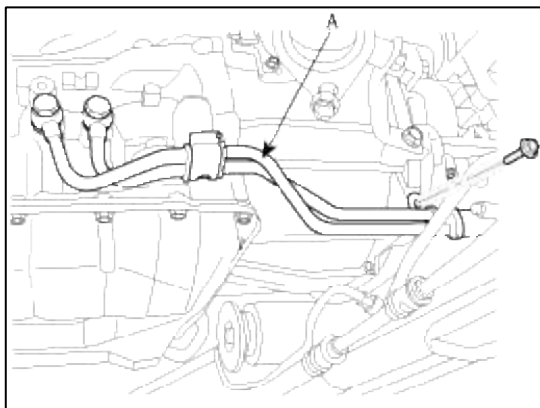
10. Remove the shift cable cover(A).



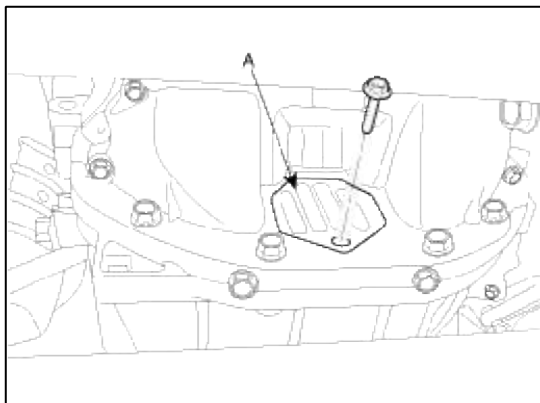
11. Remove the shift cable(A).



12. Remove the oil cooler pipes(A).



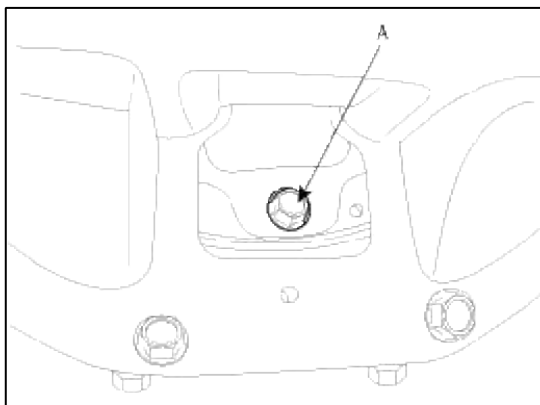
13. Remove the drive plate cover(A).



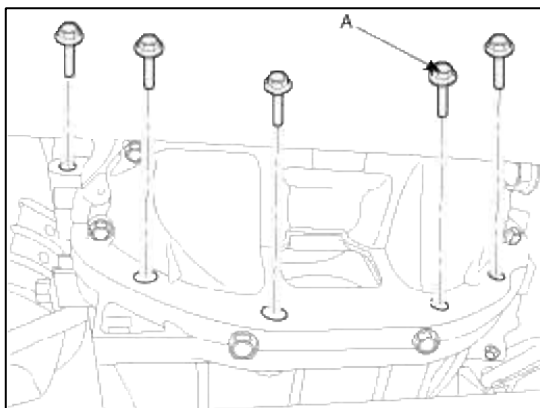
14. Remove the drive plate bolts(A).

**NOTE**

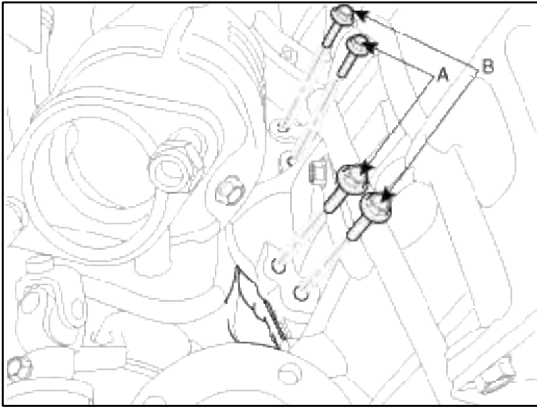
Remove the bolts(A-6ea) while rotating the crankshaft clockwise.



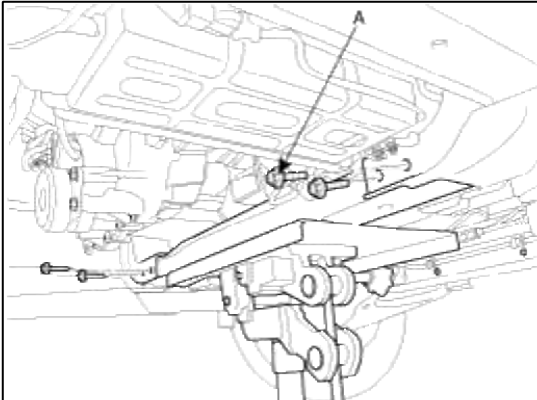
15. Remove the transmission lower mounting bolts(A).



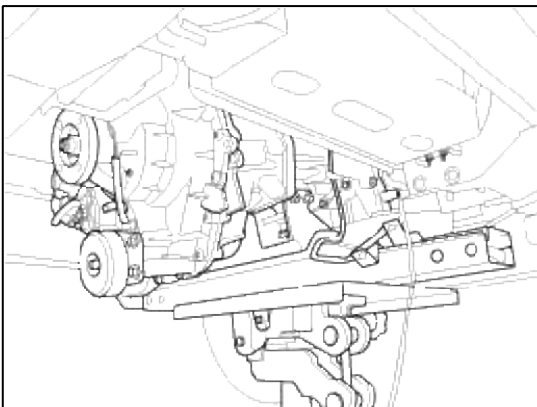
16. Remove the starter motor mounting bolts(A) and the other bolts(B).



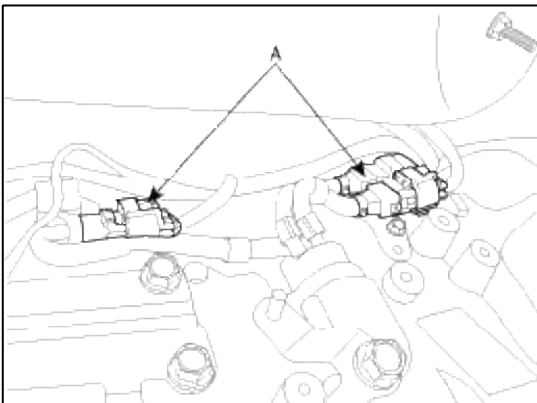
17. Remove the mounting bolts(A) while supporting the transmission with a jack.



18. Lower the jack slightly to simplify removal of electrical connectors and bolts on the upper part of the transmission.

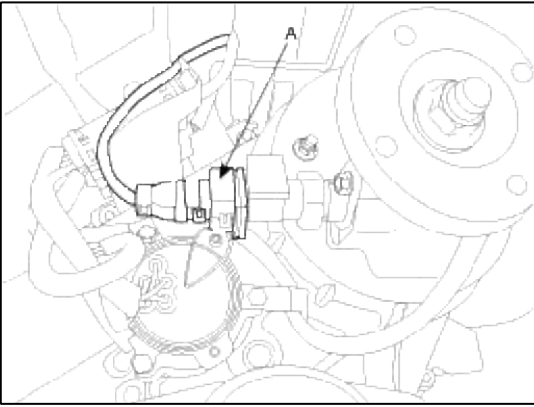


19. Disconnect the transmission wire harness connectors(A).

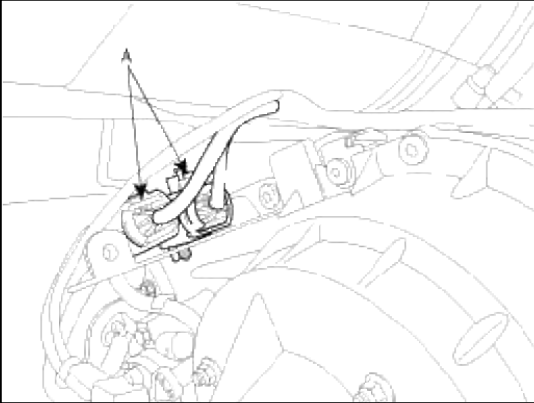




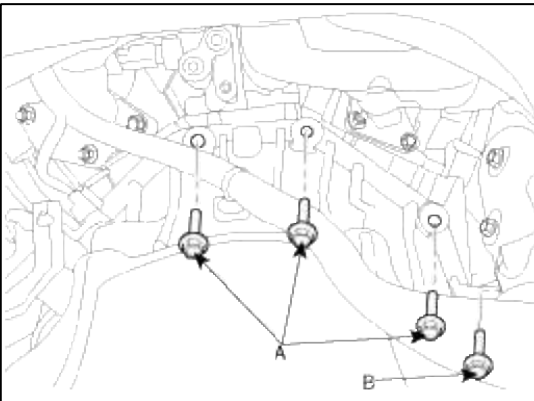
20. Remove the vehicle speed sensor connector(A).



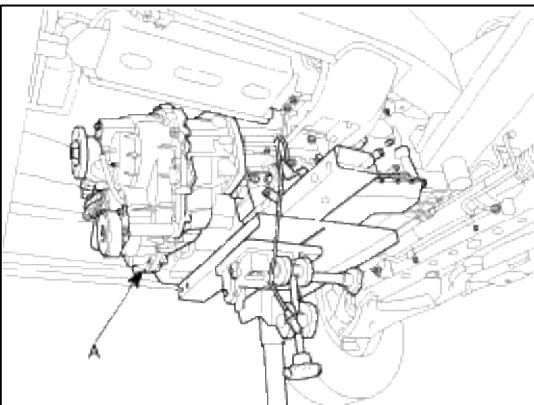
21. Remove the transfer case connectors(A). (4WD)



22. Remove the transmission upper mounting bolts(A,B).

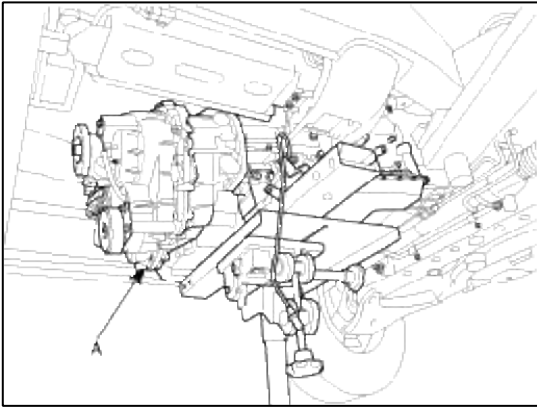


23. Remove the transmission (2WD) or transmission/transfer case assembly(4WD)(A).



## INSTALLATION

1. Using a transmission jack, install the transmission (2WD) or transmission/transfer case assembly(4WD)(A).



2. Tighten the transmission mounting bolts(A,B).

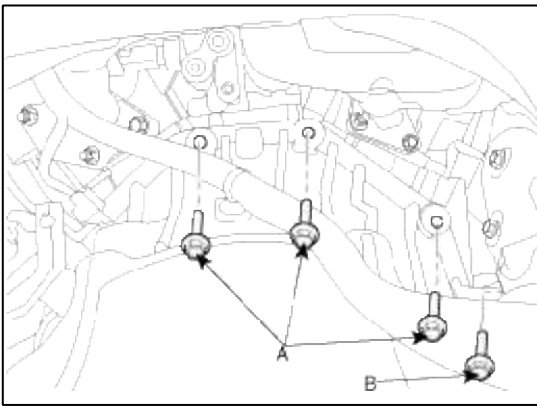
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**TORQUE**

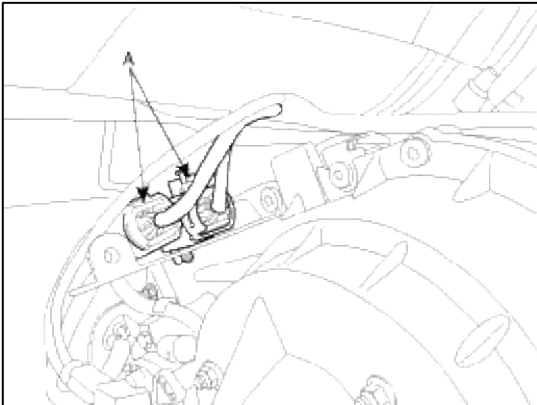
A : 30~42Nm (3.0~4.2kgf.m, 21.6~30.3lb-ft)

B : 78.4~98Nm (8.0~10kgf.m, 57.8~72.3lb-ft)

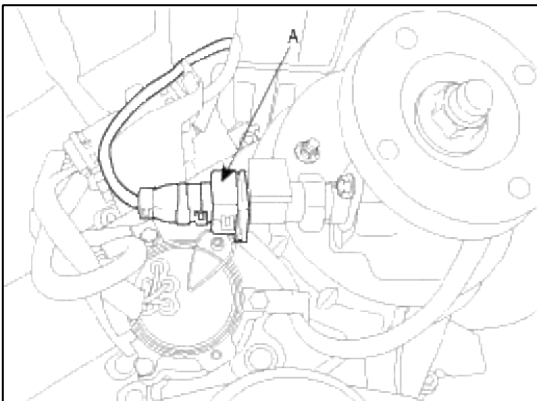
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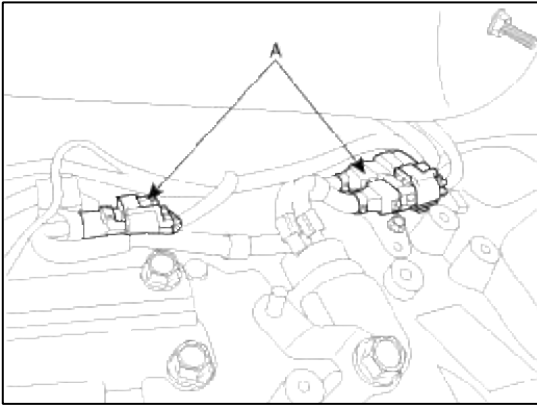
3. Install the transfer case connectors(A). (4WD)



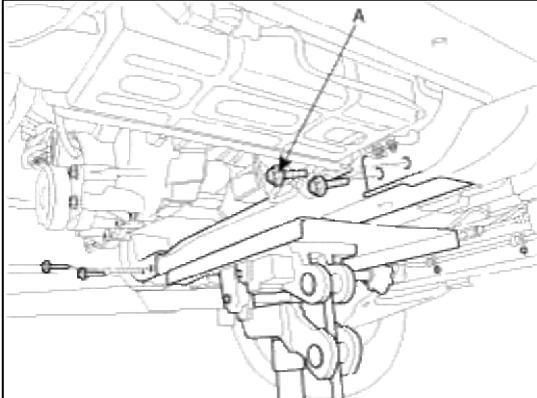
4. Install the vehicle speed sensor connector(A).



5. Connect the transmission wire harness connectors(A).



6. Install the crossmember mounting bolts(A).



7. Install the starter motor mounting bolts(A) and the other bolts(B).

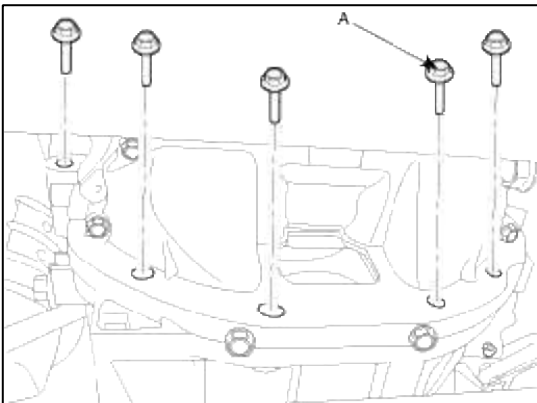
#### TORQUE

A: 50~65Nm(5.0~6.5kgf.m, 36.2~47.0lb-ft)

B : 34.3~46Nm (3.5~4.7kgf.m,25.3~33.9 lb-ft)



8. Install the Tighten the transaxle lower mounting bolts(A).



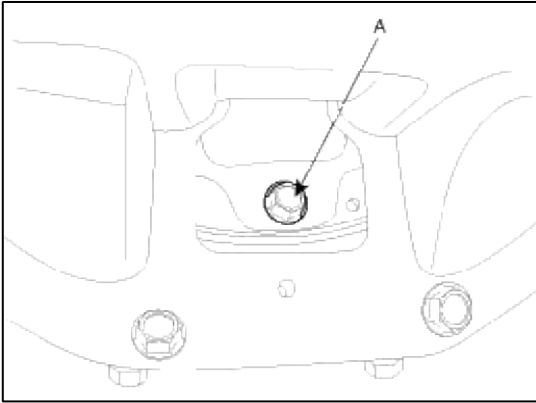
9. Install the drive plate bolts (A) by turning the timing gear.

TORQUE :

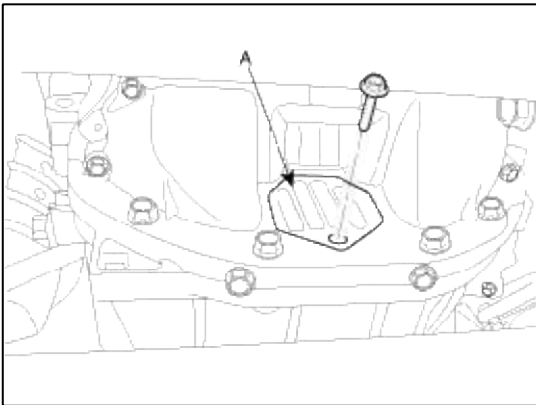
34.3~41.1Nm (3.5~4.2kgf.m, 25.3~30.3lb-ft)

**NOTE**

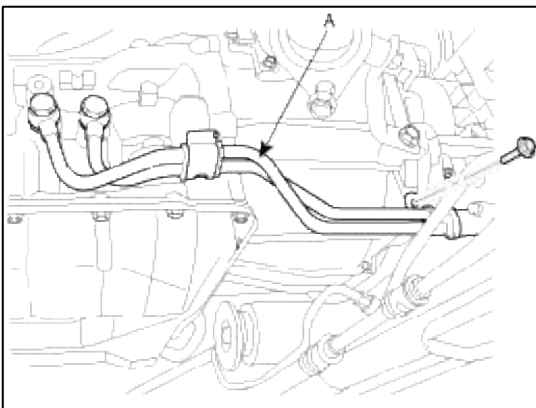
Install the bolts(A-6ea) rotating the crankshaft clockwise.



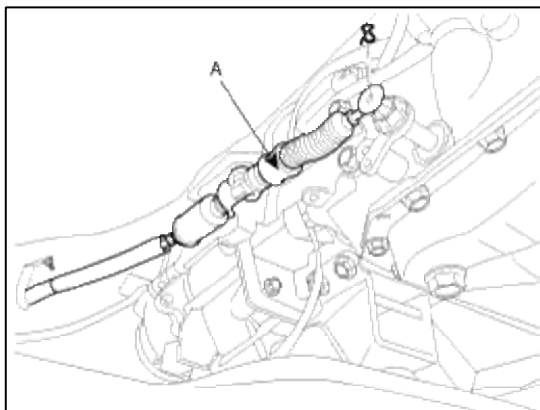
10. Install the drive plate cover(A).



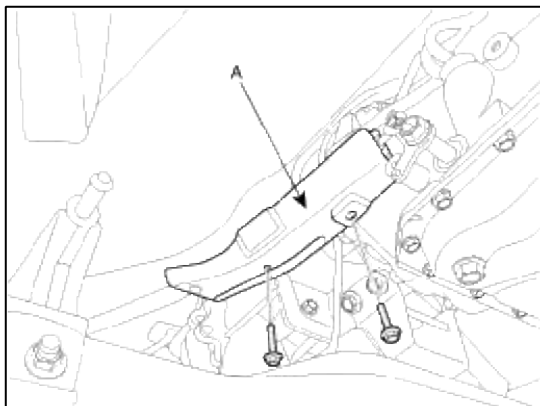
11. Install the oil cooler pipes(A).



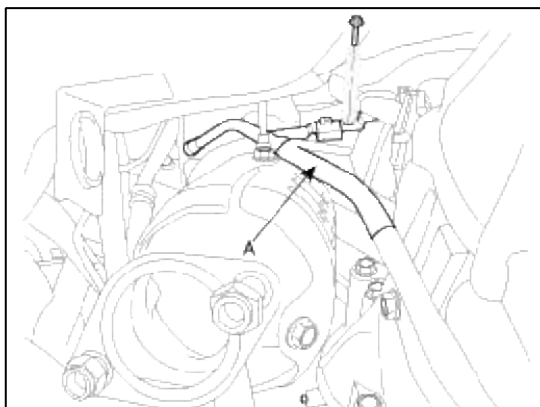
12. Install the shift cable(A).



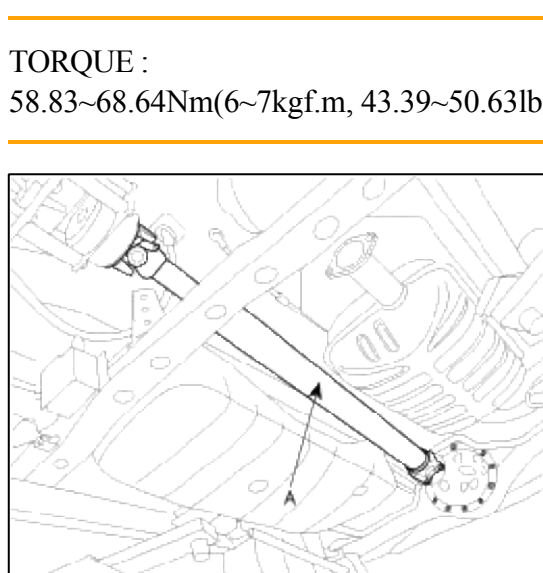
13. Install the shift cable cover(A).



14. Install the transmission oil level gauge(A).



15. Install the rear propeller shaft(A).



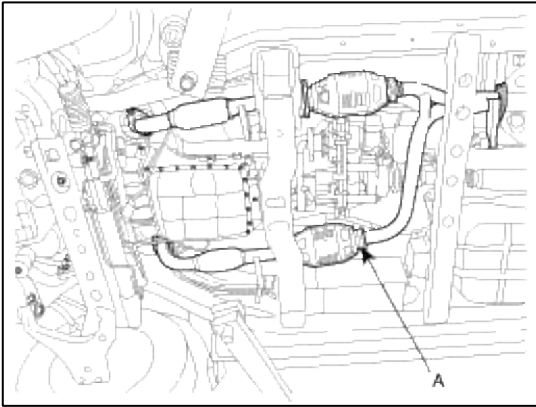
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TORQUE :

58.83~68.64Nm(6~7kgf.m, 43.39~50.63lb-ft)

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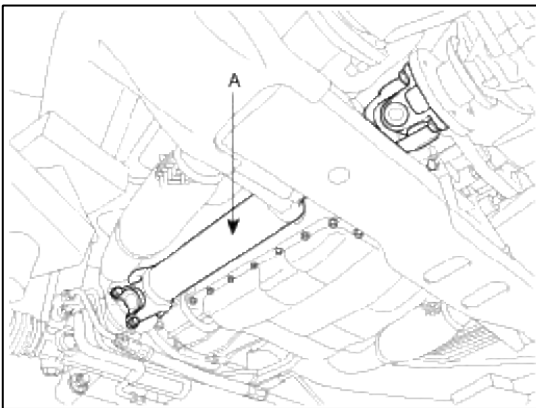
16. Install the front muffler(A) and the heat protector.



17. Install the front propeller shaft(A). (4WD)

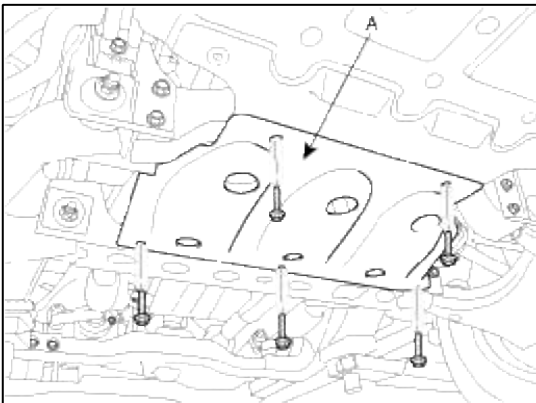
TORQUE :

58.83~68.64Nm(6~7kgf.m, 43.39~50.63lb-ft)

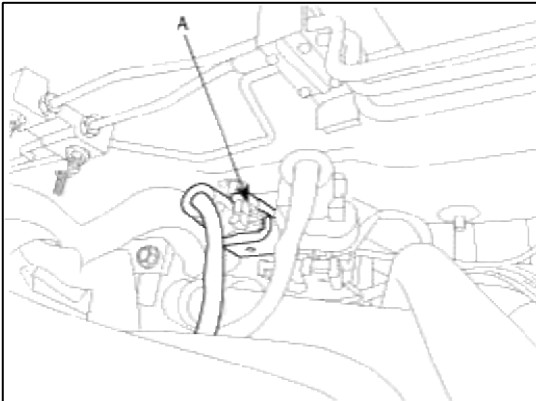
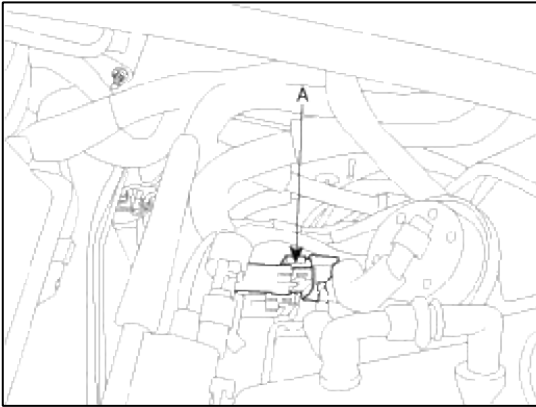


18. Refill the transmission fluid. (see 'Service adjustment procedure')

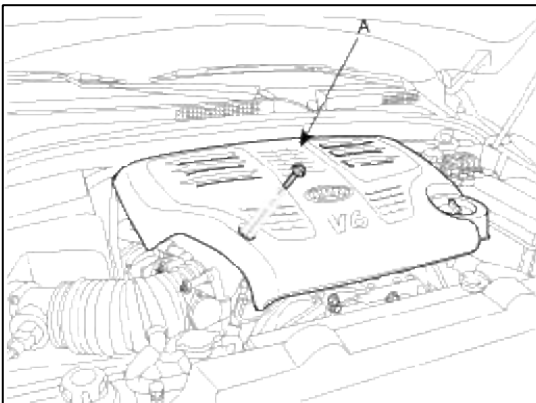
19. Install the under cover(A).



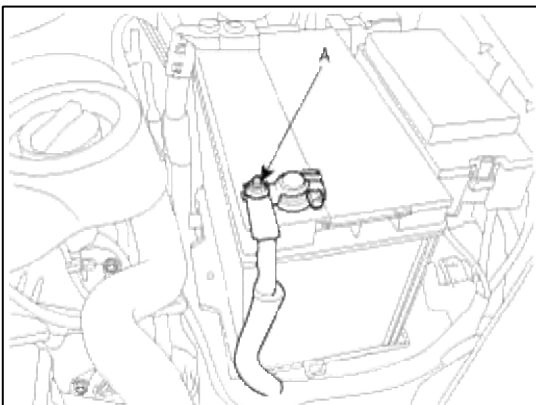
20. Install the O2 sensor connectors(A).



21. Install the engine cover(A).



22. Install the battery (-) terminal(A).



23. Refill the transmission fluid. (See 'service adjustment procedure')

### Automatic Transaxle System > Automatic Transaxle System > Troubleshooting

#### TROUBLESHOOTING

#### DIAGNOSTIC TROUBLE CODES (INSPECTION PROCEDURE)

## Check the Diagnostic Trouble Codes

1. Turn the ignition switch to OFF.
2. Connect the Hi-scan tool to the DLC connector for diagnosis.
3. Turn the ignition switch to ON.
4. Check the diagnostic trouble codes using the Hi-scan tool.
5. Read the output diagnostic trouble codes. Then follow the remedy procedures according to the "DIAGNOSTIC TROUBLE CODE DESCRIPTION" on the following pages.

**NOTE**

- A maximum of 10 diagnostic trouble codes (in the sequence of occurrence) can be stored in the Random Access Memory (RAM) incorporated within the control module.
- The same diagnostic trouble code can be stored one time only.
- If the number of stored diagnostic trouble codes or diagnostic trouble patterns exceeds 10, already stored diagnostic trouble codes will be erased in sequence, beginning with the oldest.
- If the same trouble code does not occur during 40 times continuously, memorized trouble code would be deleted automatically when the ATF temperature reaches 50°C(122°F).

6. Delete the diagnostic trouble code.
7. Disconnect the Hi-scan tool.

**NOTE**

DTC cleaning should only be done with the scan tool.

## Diagnostic trouble code table

No.	Code	Item	MIL	Remark
1	P0601	INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR	●	
2	P0641	SENSOR REFERENCE VOLTAGE "A" CIRCUIT - OPEN	●	
3	P0705	TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRND Input)	●	
4	P0711	TRANSMISSION FLUID TEMPERATURE SENSOR A RATIONALITY	●	
5	P0712	TRANSMISSION FLUID TEMPERATURE SENSOR A STUCK OFF(HIGH INPUT)	●	
6	P0713	TRANSMISSION FLUID TEMPERATURE SENSOR A STUCK ON(LOW INPUT)	●	
7	P0716	A/T INPUT SPEED SENSOR CIRCUIT - OPEN or SHORT(GND)	●	
8	P0717	A/T INPUT SPEED SENSOR CIRCUIT - NO SIGNAL	●	
9	P0721	A/T OUTPUT SPEED SENSOR CIRCUIT - OPEN or SHORT(GND)	●	
10	P0731	GEAR 1 INCORRECT RATIO	●	
11	P0732	GEAR 2 INCORRECT RATIO	●	
12	P0733	GEAR 3 INCORRECT RATIO	●	



13	P0734	GEAR 4 INCORRECT RATIO	•	
14	P0735	GEAR 5 INCORRECT RATIO	•	
15	P0741	TORQUE CONVERTER CLUTCH STUCK OFF	•	
16	P0743	TCC CONTROL SOLENOID VALVE CIRCUIT - OPEN or SHORT(GND)	•	
17	P0748	PRESSURE CONTROL SOLENOID VALVE-A CIRCUIT - OPEN or SHORT(GND)	•	
18	P0753	SHIFT SOLENOID "A(I/C SOLENOID)" CIRCUIT - OPEN or SHORT(GND)	•	
19	P0758	SHIFT SOLENOID "B(Fr/B SOLENOID)" CIRCUIT - OPEN or SHORT(GND)	•	
20	P0763	SHIFT SOLENOID "C(D/C SOLENOID)" CIRCUIT - OPEN or SHORT(GND)	•	
21	P0768	SHIFT SOLENOID "D(H &LR/C SOLENOID)" CIRCUIT - OPEN or SHORT(GND)	•	
22	P0773	SHIFT SOLENOID "E(LC/B SOLENOID)" CIRCUIT - OPEN or SHORT(GND)	•	
23	P0819	UP AND DOWN SHIFT SWITCH TO TRANSMISSION RANGE CORRELATION	X	
24	U0001	CAN COMMUNICATION BUS	•	
25	U0100	LOST COMMUNICATION WITH PCM "A"	•	

### Automatic Transaxle System > Automatic Transaxle System > Repair procedures

#### BASIC INSPECTION ADJUSTMENT

#### TRANSAXLE FLUID LEVEL

#### INSPECTION

1. Drive the vehicle until the fluid reaches normal operating temperature [70~80°C(158~176°F)].
2. Place the vehicle on a level surface.
3. Move the gear selector lever through all gear positions. This will fill the torque converter with trans fluid. Set the selector lever to the "N" (Neutral) position.
4. Before removing the oil level gauge, wipe all contaminants from around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.

#### NOTE

If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction materials, a transmission overhaul may be necessary.

5. Check that the fluid level is in the "HOT" mark on the oil level gauge. If fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" mark.

Automatic transaxle fluid :

APOLLOIL ATF RED-1K

ATF capacity: 10ℓ(10.57 US qt, 8.8 Imp.qt)

#### NOTE

Low fluid level can cause a variety of abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles, which are compressible. Therefore, pressures will be erratic, causing delayed shifting, slipping clutches and brakes, etc. Improper filling can also raise fluid level too high. When the transaxle has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of automatic transaxle fluid. In either case, air bubbles can cause overheating, and fluid oxidation, which can interfere with normal valve, clutch, and brake operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

6. Insert the oil level gauge securely.

#### NOTE

When new, automatic transmission fluid should be red, The red dye is added so the assembly plant can identify it as transmission fluid and distinguish it from engine oil or antifreeze. The red dye, which is not an indicator of fluid quality, is not permanent. As the vehicle is driven the transmission fluid will begin to look darker. The color may eventually appear light brown.

### REPLACEMENT

If you have a fluid changer, use this changer to replace the fluid. If you do not have a fluid replace the fluid by the following procedure.

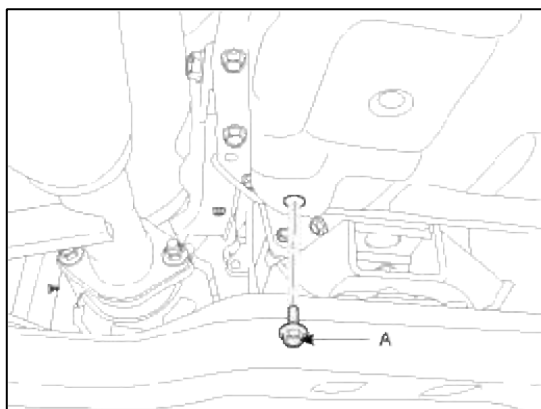
1. Disconnect the hose, which connects the transmission and the oil cooler (inside the radiator).
2. Start the engine and let the fluid drain out.

Running conditions : "N" range with engine idling

#### CAUTION

The engine should be stopped within one minute after it is started. If the fluid has all drained out before then, the engine should be stopped at that point.

3. Remove the drain plug(A) from the bottom of the transmission case to drain the fluid.



4. Install the drain plug via the gasket, and tighten it the specified torque.

#### TORQUE:

30~40Nm (3.0~4.0kgf.m, 21.7~28.9lb-ft)

5. Pour the new fluid in through the oil filler tube.

#### CAUTION

Stop pouring if the full volume of fluid cannot be poured in.

6. Repeat the procedure in step (2).

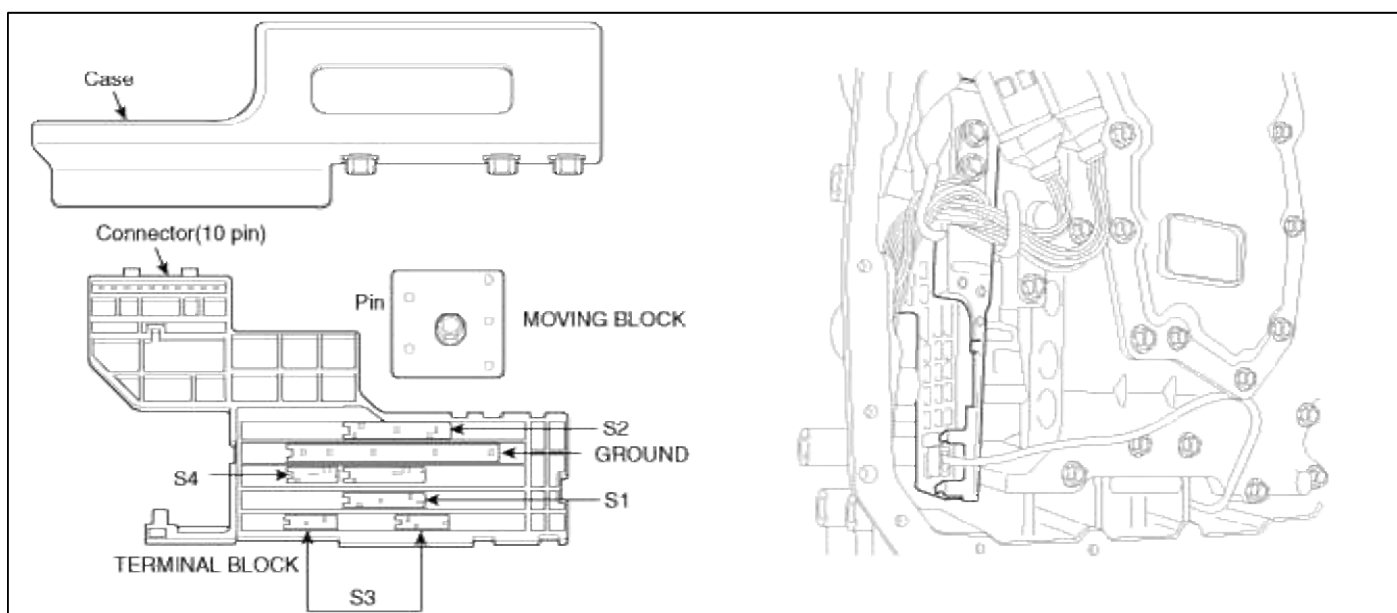
#### NOTE

Check the old fluid for contamination. If it has been contaminated, repeat the steps (5) and (6).

7. Pour the new fluid in through the oil filler tube.
8. Reconnect the hose, which was disconnected in step (1) above, and firmly replace the oil level gauge.  
(In case of this "replace", this means after wiping off any dirt around the oil level gauge, insert it into the filler tube.)
9. Start the engine and run it at idle for 1~2 minutes.
10. Move the select lever through all positions, and then move it to the "N" or "P" position.
11. Drive the vehicle until the fluid temperature rises to the normal temperature (70~80°C(158~176°F)), and then check the fluid level again. The fluid level must be at the HOT mark.
12. Firmly insert the oil level gauge into the oil filler tube.

### Automatic Transaxle System > Troubleshooting > P0705

#### COMPONENT LOCATION



#### GENERAL DESCRIPTION

When the shift lever is in the D (Drive) position the output signal of Tansaxle Range Switch is 12V and in all other positions the voltage is 0V. The TCM judges the shift lever position by reading all signals, for the

TRANSMISSION Range Switch, simultaneously.

#### DTC DESCRIPTION

The TCM sets this code when patterns are out of specifications.

The TRANSMISSION Range Switch has no output signal for an extended period of time.

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Range decision by switch pattern	<ul style="list-style-type: none"> <li>• OPEN OR SHORT IN CIRCUIT</li> <li>• Faulty TRANSMISSION RANGE SWITCH</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	• Sensor supply voltage in valid range	
<b>Threshold value</b>	• "INHIBITOR SWITCH" pattern check.	
<b>Diagnostic Time</b>	• More than 10sec	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• SELECT POSITION IS REGARDED AS "D"</li> <li>• INDICATOR DECISION "OFF"</li> <li>• REVERSE LAMP SIGNAL "OFF"</li> </ul>	

#### Monitor Scantool Data

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "TRANSMISSION RANGE SWITCH" parameter on the scantool.
4. Move selector lever from "P" range to "D" range.

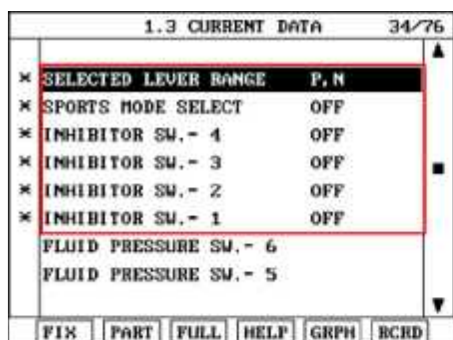


FIG.1)

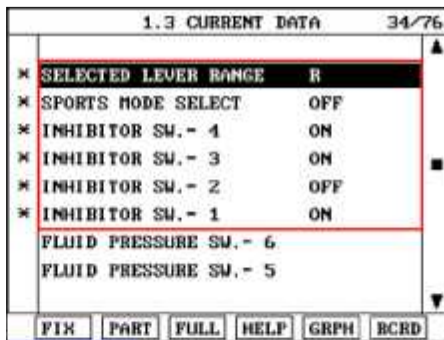


FIG.2)

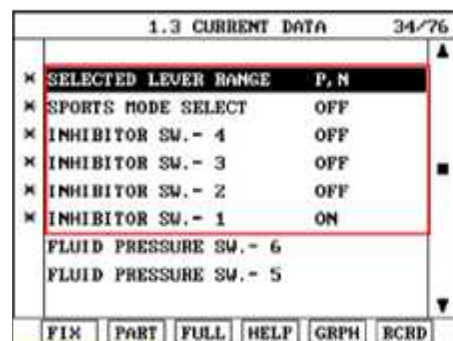


FIG.3)

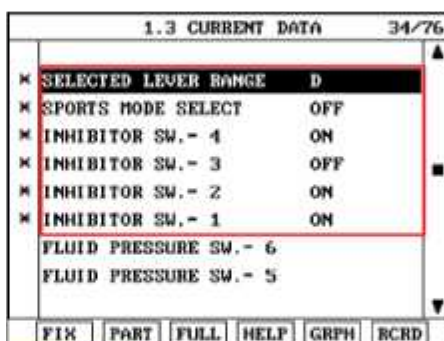


FIG.4)

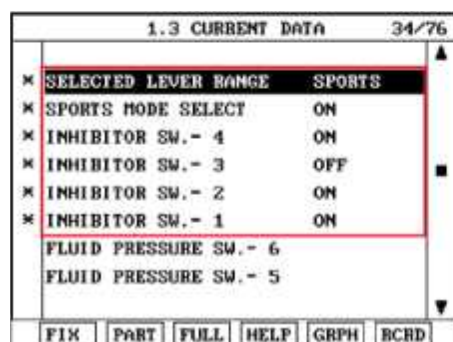


FIG.5)

FIG.1) P RANGE  
 FIG.2) R RANGE  
 FIG.3) N RANGE  
 FIG.4) D RANGE  
 FIG.5) SPORTS MODE

5. Does "TRANSMISSION RANGE SWITCH" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of vehicle Repair" procedure.

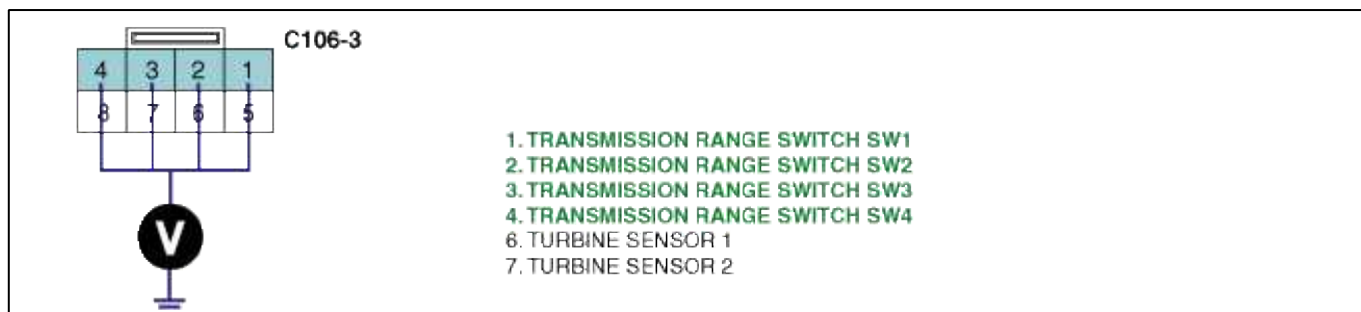
**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Disconnect "C106-3" connector.
2. Ignition "ON" & Engine "OFF".
3. Measure voltage between each terminal "1,2,3,4" of the TCM side harness connector and chassis ground.

Specification : approx. 5V



4. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
If signal circuit in harness is OK, Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect "C106-3" connector.
3. Measure the resistance between each terminal of the sensor.

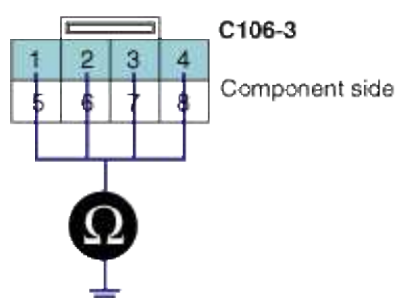
Specification :

PIN No.	GND	1(S1)	2(S2)	3(S3)	4(S4)	IND
P-ST	●					P
P-R(middle)	●				●	-
R	●	●		●	●	R
N-R(middle)	●	●	●		●	-
N-ST	●	●				N
N-D(middle)	●	●	●	●		-
D	●	●	●		●	D

● : SWITCH IS ON(GND LEVER)

- : RANGE INDICATOR LAMP 'OFF' AND MAINTAIN PREVIOUS RANGE

**[RANGE SWITCH continuity check table]**



## 4. Is resistance within specifications?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Substitute with a known-good "TRANSMISSION RANGE SWITCH" and check for proper operation. If the problem is corrected, replace "TRANSMISSION RANGE SWITCH" as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

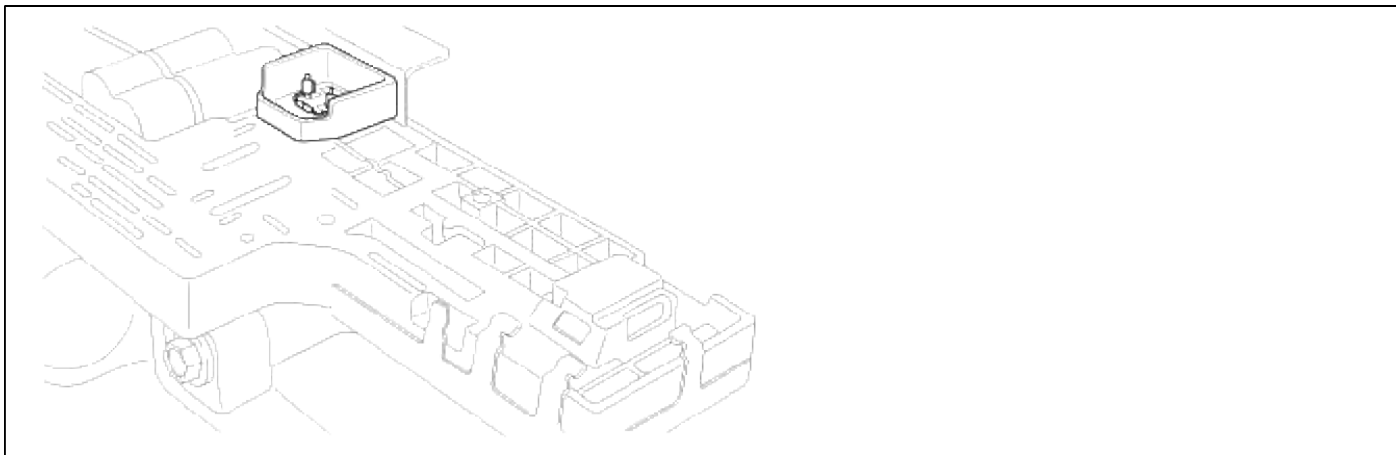
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

**Automatic Transaxle System > Troubleshooting > P0711**

## COMPONENT LOCATION



## GENERAL DESCRIPTION

The automatic transmission fluid(ATF) temperature sensor A is installed in the INHIBITOR SWITCH and fluid(ATF) temperature sensor B is installed in the valve body. Sensor B measured the temperature of the oil flowing from the torque converter. The TCM supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies.

## DTC DESCRIPTION

This DTC is for checking sensor failure. This code is set if the temperture data from Oil Temperture sensor is fixed between -4°F and 32°F or 32°F and 68°F for 10min.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Rationality	ATF T/S : Automatic Transmission Fluid Temperature Sensor  • OPEN OR SHORT IN CIRCUIT • Faulty ATF T/S 1 • Faulty TCM
<b>Enable Conditions</b>	• Always	
<b>Threshold value</b>	• Oil temp. at IG "ON" - Coolant temp. at IG "ON" >10°C	
<b>Diagnostic Time</b>	• More than 2 sec	
<b>Fail Safe</b>	• Fluid temperature is regarded as 80°C	

## Monitor Scantool Data

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR "1" parameter on the scantool.

Specification : Increasing Gradually

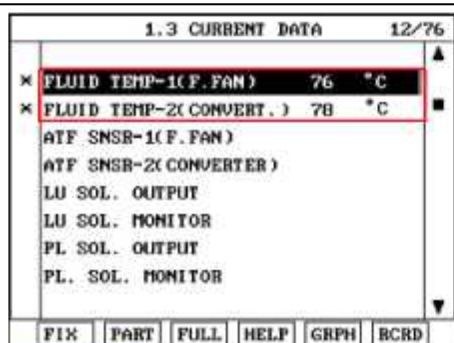


FIG.1)

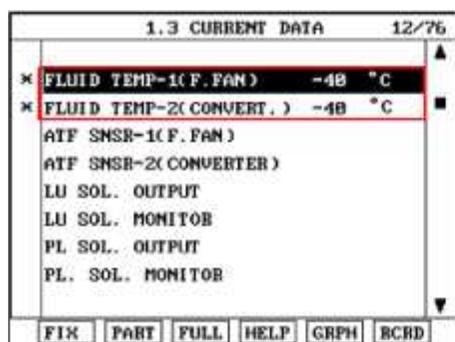


FIG.2)

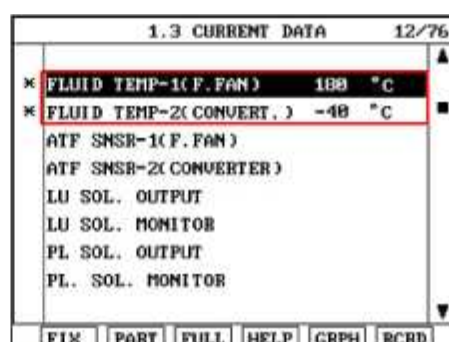


FIG.3)

FIG.1) Normal

FIG.2) Signal harness open

FIG.3) Signal harness ground short



4. Does "TRANSMISSION FLUID TEMPERATURE SENSOR " follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of vehicle Repair" procedure.

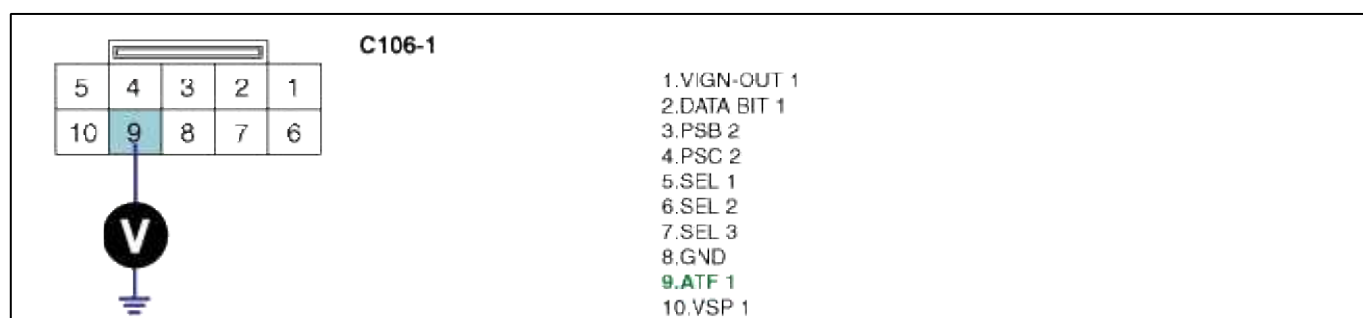
**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "ATF 1[C106-1] and ATF 2[C106-2]" connector.
3. Measure the voltage between terminal "9" of the "ATF 1 [C106-1]" harness connector and chassis ground.

Specification : Approx. 5 V



4. Is voltage within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Go to "CHECK TCM" of the "Component Inspection" procedure.

## COMPONENT INSPECTION

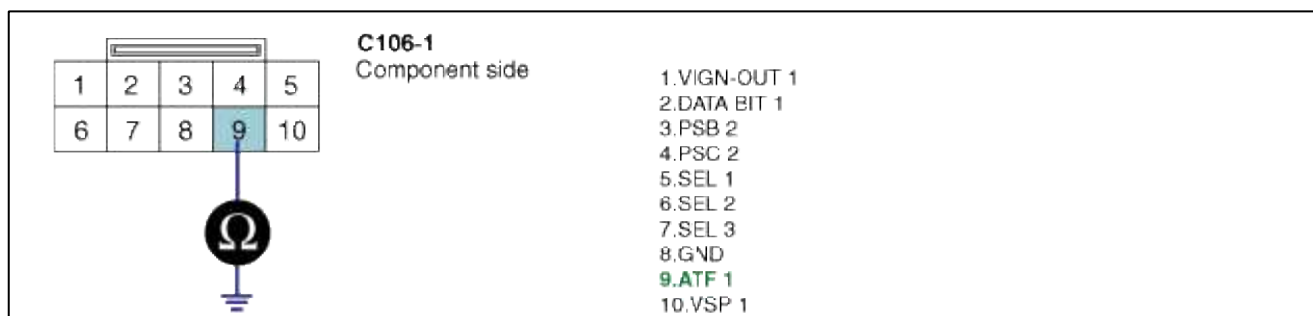
## 1. CHECK "TRANSMISSION FLUID TEMPERATURE SENSOR"

- (1) Ignition "OFF" .
- (2) Disconnect the "ATF 1 [C106-1] and ATF 2 [C106-2]" connector.
- (3) Measure the resistance between terminal "9" of the "ATF 1 [C106-1]" harness connector and chassis ground.

Specification : Refer to " Reference data"

**[Reference data]**

	PIN No	TEMPERATURE (°F)	RESISTANCE (KΩ)	VOLTAGE
ATF 1	C106-1 : 9 ~ GND	32	Approx. 15	Approx. 3
		68	Approx. 6.5	Approx. 2
		176	Approx. 0.9	Approx. 0
ATF 2	C106-2 : 1 ~ GND	32	Approx. 10.5	Approx. 3
		68	Approx. 4.3	Approx. 2
		176	Approx. 0.5	Approx. 0



- (4) Is resistance within specifications?

**YES**

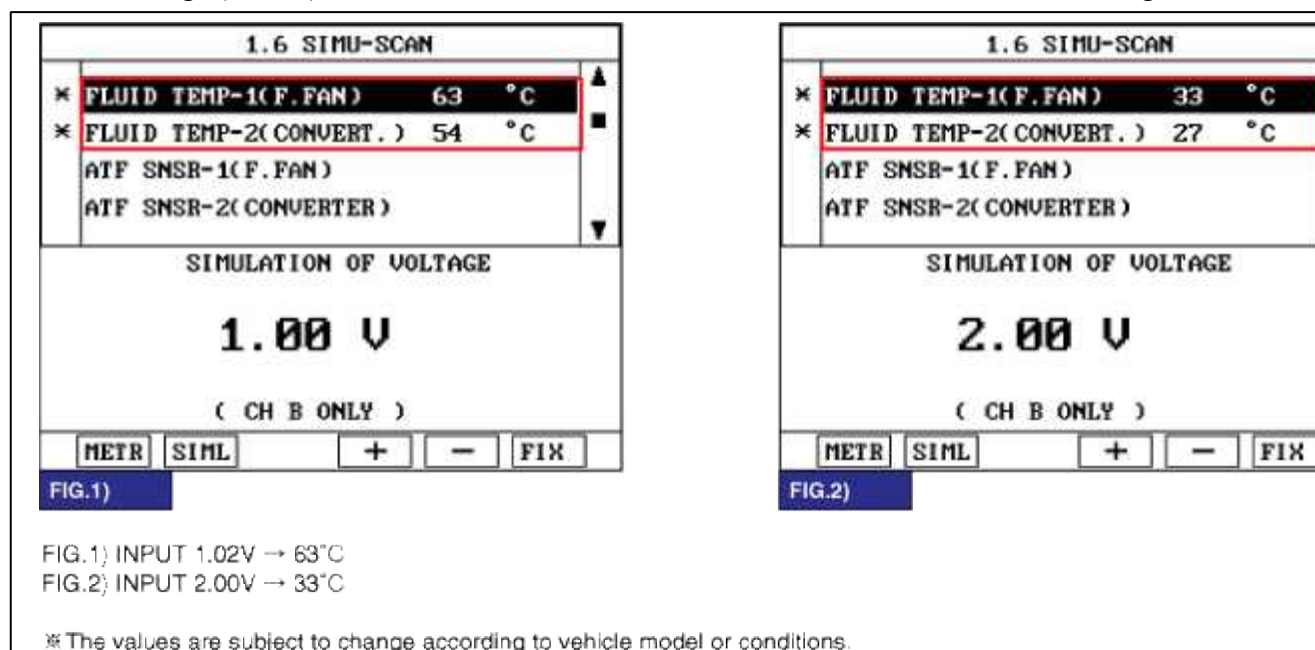
Go to "CHECK PCM/TCM" as below.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
Replace "TRANSMISSION FLUID TEMPERATURE SENSOR 1" as necessary and Go to "Verification of Vehicle Repair" procedure.

## 2. CHECK TCM

- (1) Ignition "ON" & Engine "OFF".
- (2) Disconnect the "ATF 1 [C106-1]" connector.
- (3) Install scantool and access "SIMU-SCAN" mode.
- (4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR 1, 2" signal circuit.



- (5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorated damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace T as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

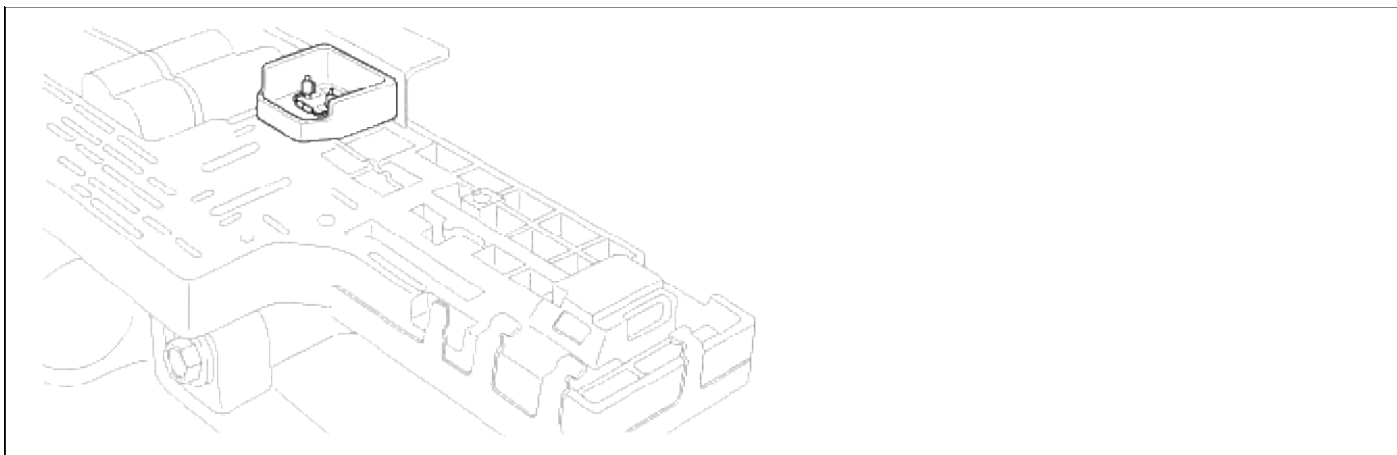
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > P0712

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The automatic transmission fluid(ATF) temperature sensor A is installed in the INHIBITOR SWITCH and fluid(ATF) temperature sensor B is installed in the valve body. Sensor B measured the temperature of the oil flowing from the torque converter. The TCM supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic transmission fluid(ATF) temperature provides very important data for the TCM's control of the Torque Converter Clutch, and is also used for many other purposes.

### DTC DESCRIPTION

This DTC is for checking sensor failure. This code is set if the temperture data from Oil Temperture sensor is fixed between -4°F and 32°F or 32°F and 68°F for 10min.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check the voltage range	ATF T/S : Automatic Transmission Fluid Temperature Sensor  • OPEN IN CIRCUIT • Faulty ATF T/S 1
<b>Enable Conditions</b>	• Battery voltage >10V	
<b>Threshold value</b>	• Input voltage < 0.05V	
<b>Diagnostic Time</b>	• More than 2 sec	
<b>Fail Safe</b>	• Fluid temperature is regarded as 80°C	

### Monitor Scantool Data

1. Connect scantool to data link connector(DLC).
2. Engine "ON".

### 3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR "1" parameter on the scantool.

Specification : Increasing Gradually

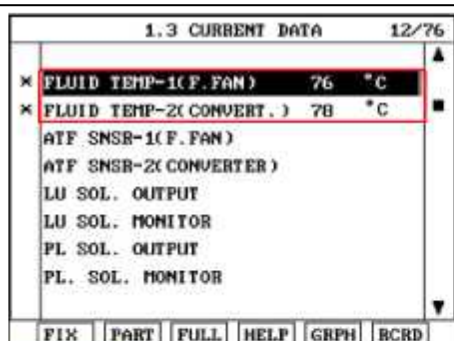


FIG.1)

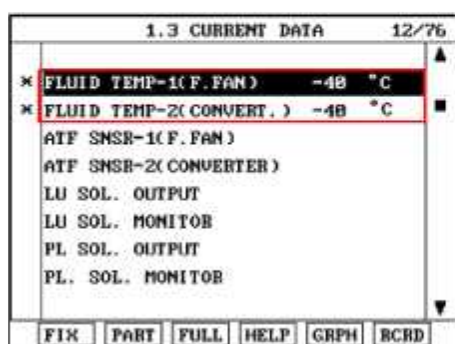


FIG.2)

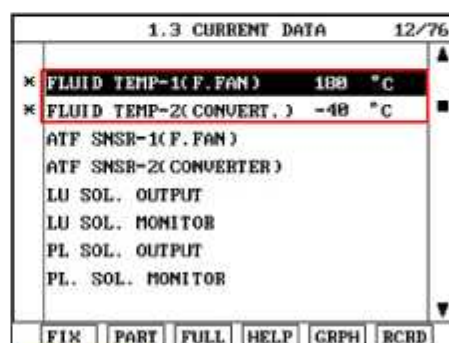


FIG.3)

FIG.1) Normal

FIG.2) Signal harness open

FIG.3) Signal harness ground short

### 4. Does "TRANSMISSION FLUID TEMPERATURE SENSOR " follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

### TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of vehicle Repair" procedure.

**NO**

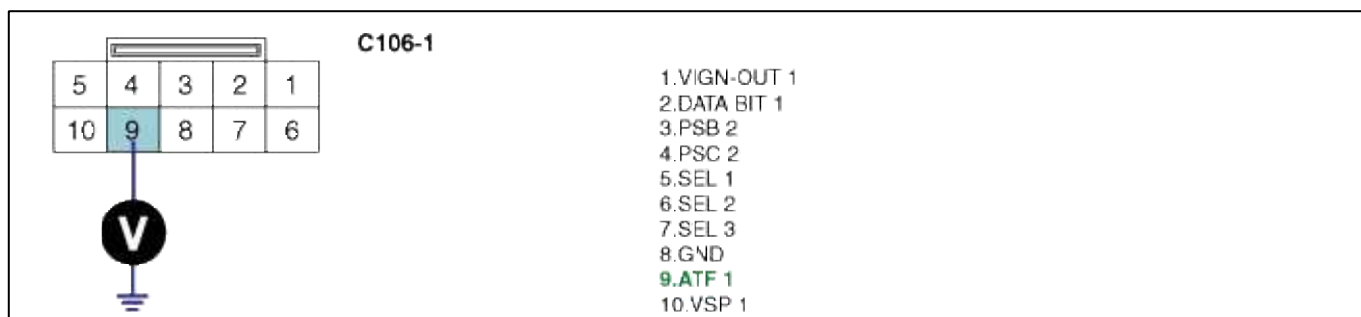
Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "ATF 1[C106-1] and ATF 2[C106-2]" connector.

3. Measure the voltage between terminal "9" of the "ATF 1 [C106-1]" harness connector and chassis ground.

Specification : Approx. 5 V



4. Is voltage within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. CHECK "TRANSMISSION FLUID TEMPERATURE SENSOR"

(1) Ignition "OFF" .

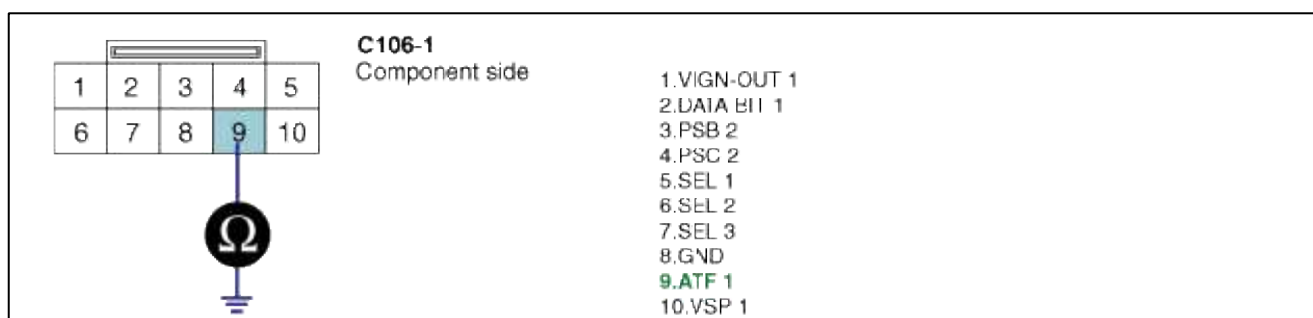
(2) Disconnect the "ATF 1 [C106-1] and ATF 2 [C106-2]" connector.

(3) Measure the resistance between terminal "9" of the "ATF 1 [C106-1]" harness connector and chassis ground.

Specification : Refer to " Reference data"

### [Reference data]

	PIN No	TEMPERATURE (°F)	RESISTANCE (KΩ)	VOLTAGE
ATF 1	C106-1 : 9 ~ GND	32	Approx. 15	Approx. 3
		68	Approx. 6.5	Approx. 2
		176	Approx. 0.9	Approx. 0
ATF 2	C106-2 : 1 ~ GND	32	Approx. 10.5	Approx. 3
		68	Approx. 4.3	Approx. 2
		176	Approx. 0.5	Approx. 0



(4) Is resistance within specifications?

**YES**

Go to "CHECK PCM/TCM" as below.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
Replace "TRANSMISSION FLUID TEMPERATURE SENSOR 1" as necessary and Go to "Verification of Vehicle Repair" procedure.

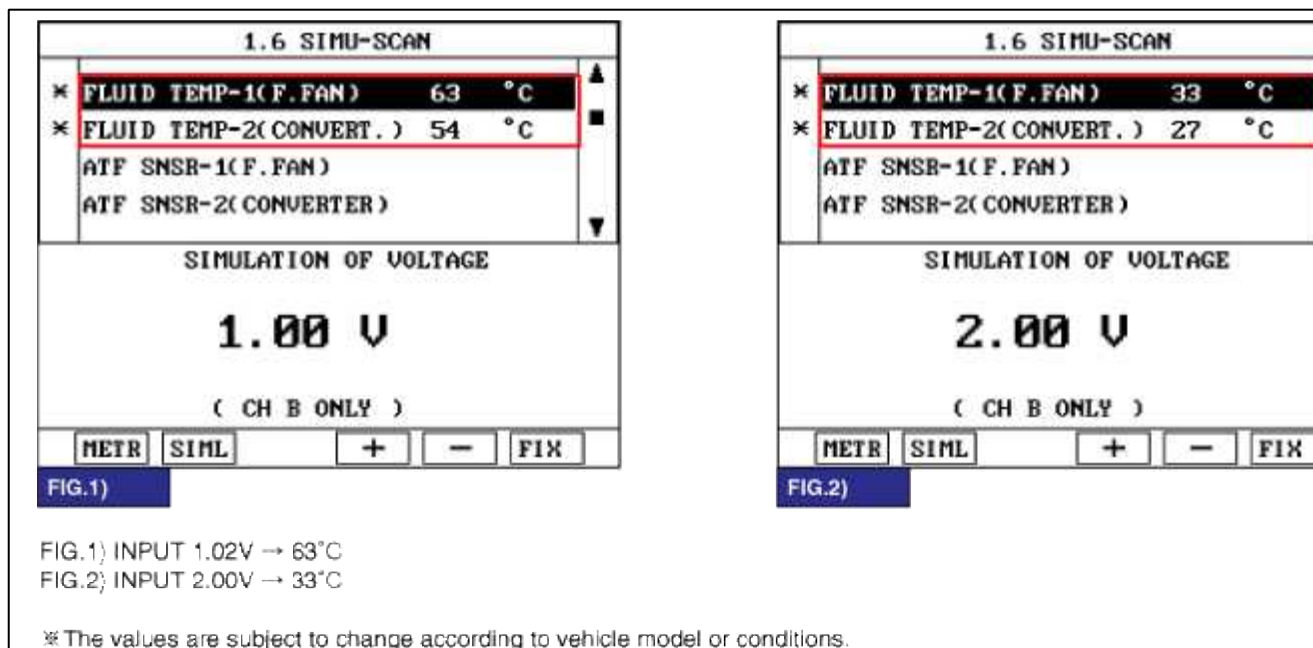
## 2. CHECK TCM

(1) Ignition "ON" & Engine "OFF".

(2) Disconnect the "ATF 1 [C106-1]" connector.

(3) Install scantool and access "SIMU-SCAN" mode.

(4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR 1, 2" signal circuit.



(5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorated damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

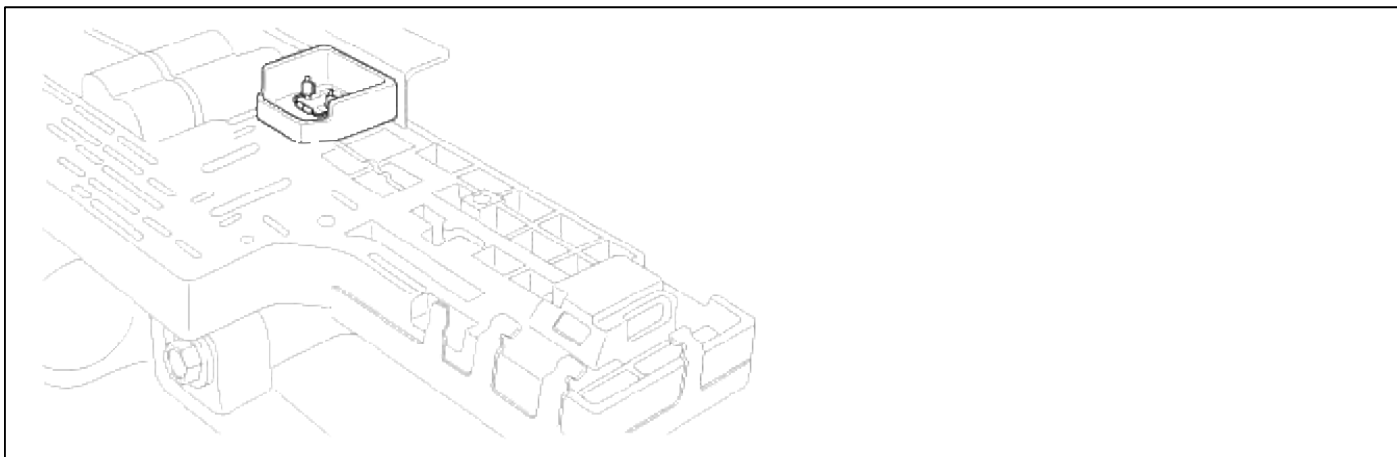
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

**Automatic Transaxle System > Troubleshooting > P0713****COMPONENT LOCATION****GENERAL DESCRIPTION**

The automatic transmission fluid(ATF) temperature sensor A is installed in the INHIBITOR SWITCH and fluid(ATF) temperature sensor B is installed in the valve body. Sensor B measured the temperature of the oil flowing from the torque converter. The TCM supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic transmission fluid(ATF) temperature provides very important data for the TCM's control of the Torque Converter Clutch, and is also used for many other purposes.

**DTC DESCRIPTION**

This DTC is for checking sensor failure. This code is set if the temperature data from Oil Temperature sensor is fixed between -4°F and 32°F or 32°F and 68°F for 10min.

**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• Check the voltage range</li> </ul>	ATF T/S : Automatic Transmission Fluid Temperature Sensor  <ul style="list-style-type: none"> <li>• OPEN OR SHORT IN CIRCUIT</li> <li>• Faulty ATF T/S 1</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Oil temp. at IG "ON" <math>\leq -39^{\circ}\text{C}</math></li> <li>• Engine speed <math>&gt; 1000\text{rpm}</math></li> <li>• Output speed <math>\geq 500\text{rpm}</math></li> <li>• Engine coolant temp. <math>\geq 70^{\circ}\text{C}</math></li> <li>• Delay time = 160sec</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Input voltage <math>&gt; 4.8\text{V}</math></li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• 10 minutes accumulative total</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• Fluid temperature is regarded as <math>80^{\circ}\text{C}</math></li> </ul>	

**Monitor Scantool Data**

1. Connect scantool to data link connector(DLC).
2. Engine "ON".



### 3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR "1" parameter on the scantool.

Specification : Increasing Gradually

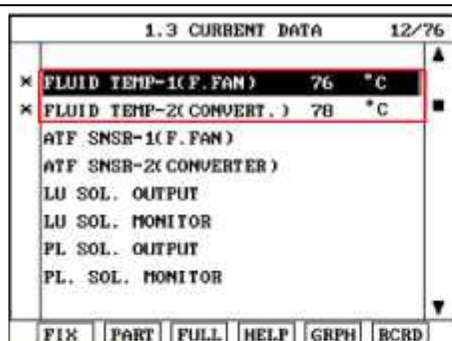


FIG.1)

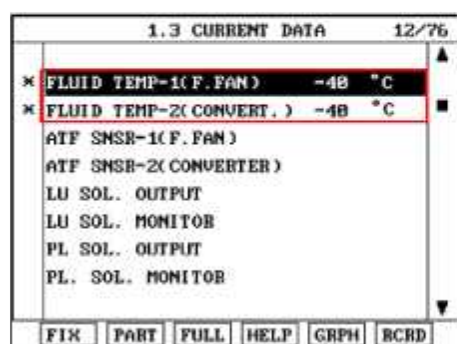


FIG.2)

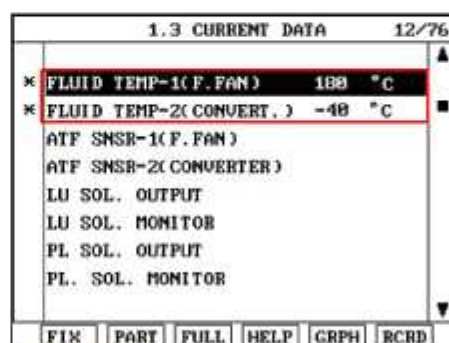


FIG.3)

FIG.1) Normal

FIG.2) Signal harness open

FIG.3) Signal harness ground short

### 4. Does "TRANSMISSION FLUID TEMPERATURE SENSOR " follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

### TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

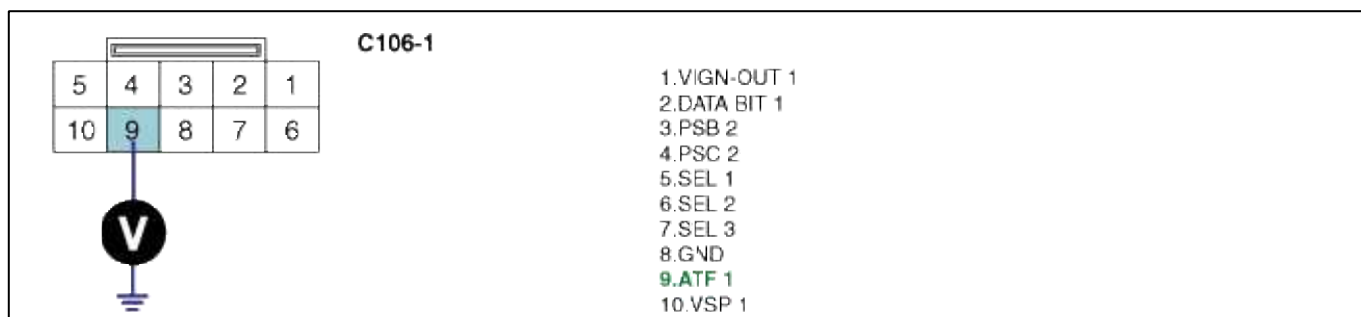
Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "ATF 1 [C106-1] and ATF 2 [C106-2]" connector.

3. Measure the voltage between terminal "9" of the "ATF 1 [C106-1]" harness connector and chassis ground.

Specification : Approx. 5 V



4. Is voltage within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short to ground in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. CHECK "TRANSMISSION FLUID TEMPERATURE SENSOR"

(1) Ignition "OFF" .

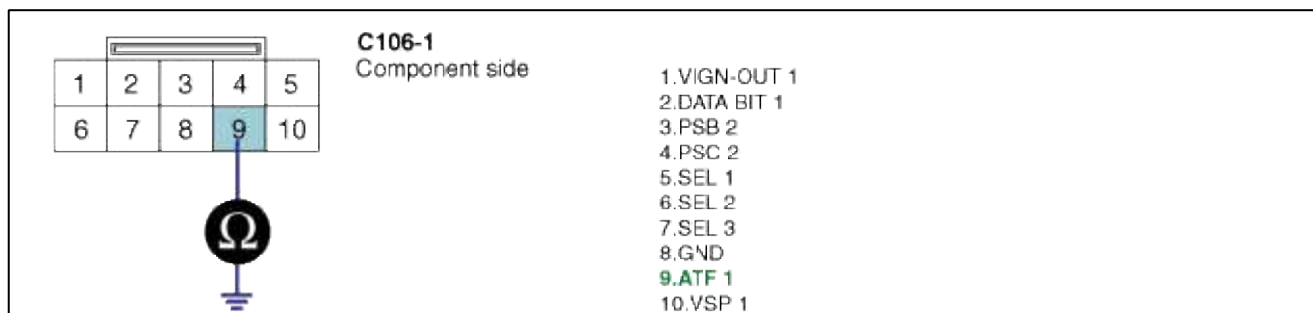
(2) Disconnect the "ATF 1 [C106-1] and ATF 2 [C106-2]" connector.

(3) Measure the resistance between terminal "9" of the "ATF 1 [C106-1]" harness connector and chassis ground.

Specification : Refer to "Reference data"

#### [Reference data]

	PIN No	TEMPERATURE (°F)	RESISTANCE (KΩ)	VOLTAGE
ATF 1	C106-1 : 9 ~ GND	32	Approx. 15	Approx. 3
		68	Approx. 6.5	Approx. 2
		176	Approx. 0.9	Approx. 0
ATF 2	C106-2 : 1 ~ GND	32	Approx. 10.5	Approx. 3
		68	Approx. 4.3	Approx. 2
		176	Approx. 0.5	Approx. 0



(4) Is resistance within specifications?

**YES**

Go to "CHECK PCM/TCM" as below.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
Replace "TRANSMISSION FLUID TEMPERATURE SENSOR 1" as necessary and Go to "Verification of Vehicle Repair" procedure.

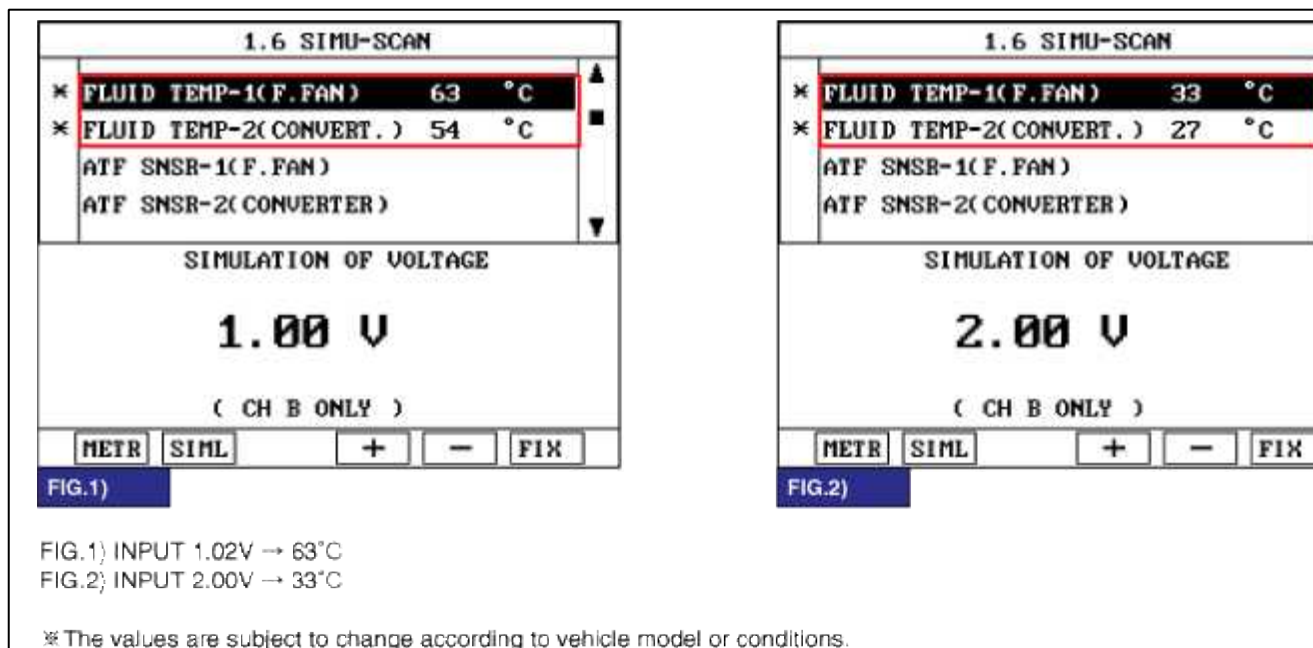
## 2. CHECK TCM

(1) Ignition "ON" & Engine "OFF".

(2) Disconnect the "ATF 1 [C106-1]" connector.

(3) Install scantool and access "SIMU-SCAN" mode.

(4) Simulate voltage (0→5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR 1, 2" signal circuit.



(5) Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorated damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Using a scantool, Clear DTC.

3. Operate the vehicle within DTC Enable conditions in General information.

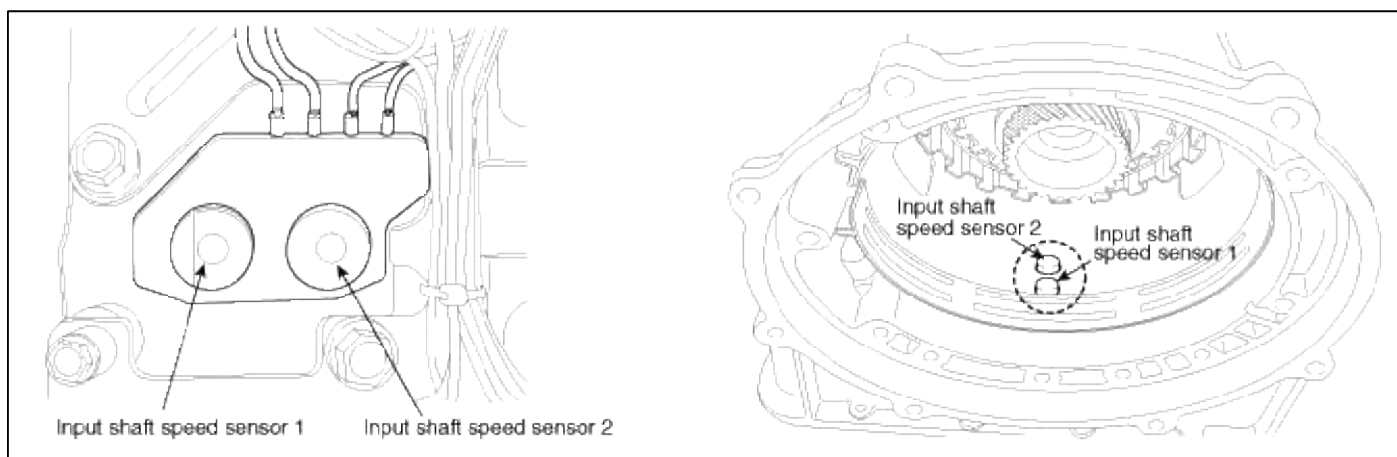
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

**Automatic Transaxle System > Troubleshooting > P0716****COMPONENT LOCATION****GENERAL DESCRIPTION**

The Input Sensor of RXC Auto transmission is composed of S1(Sensor1) and S2(Sensor2). S1 inputs signal to TCM only at 4th gear and S2 does at 1st, 2nd, 3rd, 4th and 5th gear. Therefore, sensing pulse frequency generated by both signals, TCM calculates Inputshaft speed and compute Turbine rotation. This value is mainly used to control the optimum fluid pressure during shifting.

**DTC DESCRIPTION**

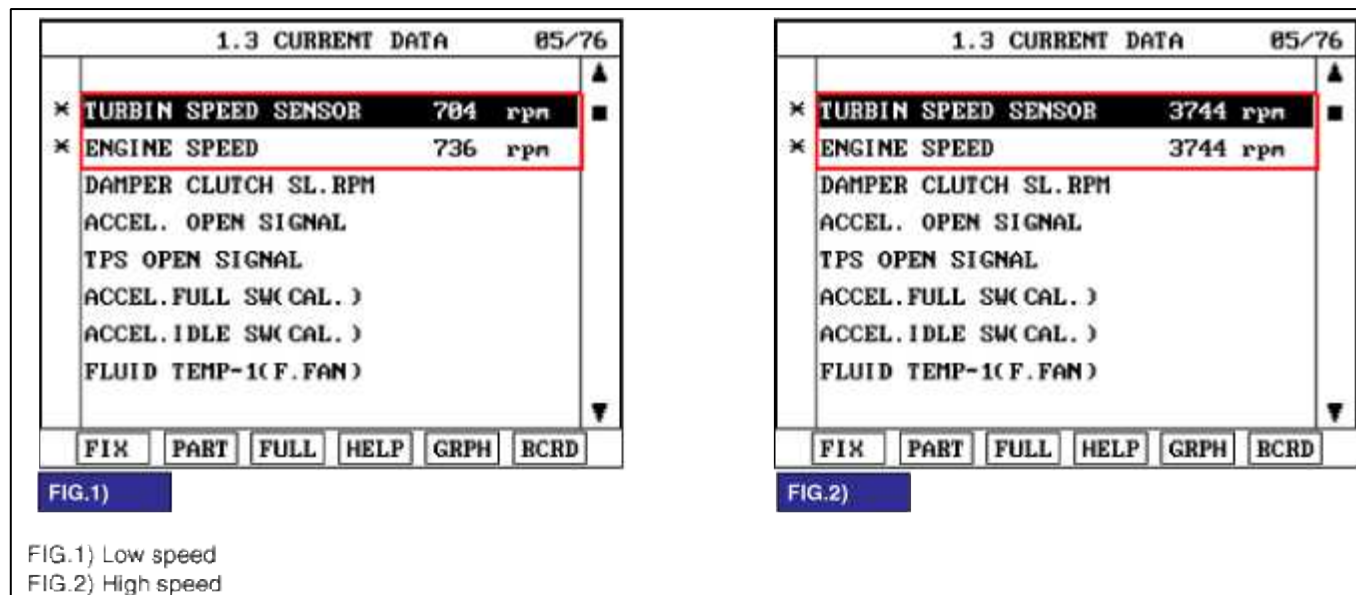
The TCM sets this code if an output pulse-signal is not detected, from the INPUT SPEED SENSOR 1 or 2, when the vehicle is running faster than 5MPH(8km/h). The Fail-Safe function will be set by the TCM if this code is detected.

**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• Speed rationality check</li> </ul>	<ul style="list-style-type: none"> <li>• Signal circuit is open or short</li> <li>• Sensor power circuit is open</li> <li>• Sensor ground circuit is open</li> <li>• Faulty INPUT SPEED SENSOR 1</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Battery voltage &gt; 10V</li> <li>• Output speed &gt;200rpm</li> <li>• Engine speed &gt;700 rpm</li> <li>• State of "TRANSMISSION" is "STATIC"</li> <li>• The time after the last shift was finished 500msec</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Input speed1 &gt;100rpm</li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• More than 2sec</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• "Input speed" is regarded as 600rpm(<math>N_t = 600\text{rpm}</math>)</li> <li>• Shift prevention over 4th gear</li> <li>• Prevention of manual shift</li> <li>• Prevention of pressure adaptation</li> </ul>	

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "INPUT SPEED SENSOR 1" parameter on the scantool.
4. Driving at speed of over 12.42MPH(20km/h) at 1gear.

Specification : Increasing Gradually



5. Does "INPUT SPEED SENSOR" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

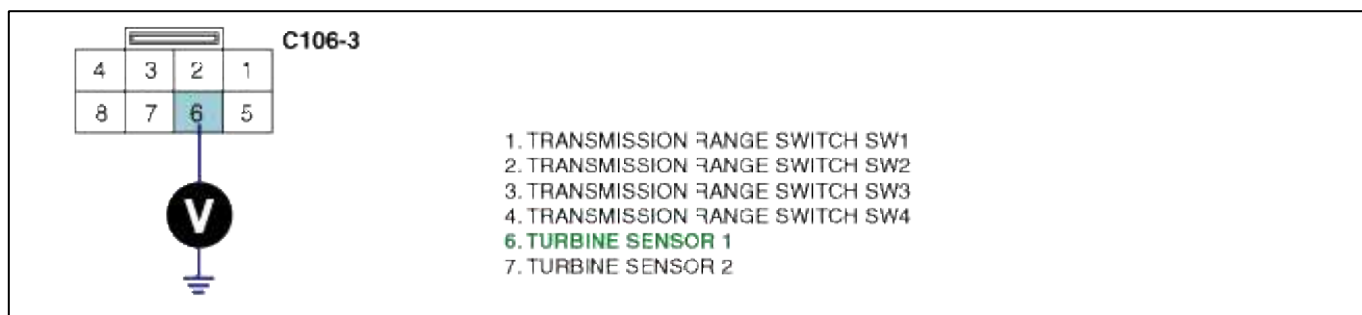
Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "C106-3" connector.

3. Measure voltage between terminal "6" of the C106-3 harness connector and chassis ground.

Specification : Approx. 5 V



4. Is voltage within specifications?

**YES**

Go to "Power supply circuit inspection" procedure.

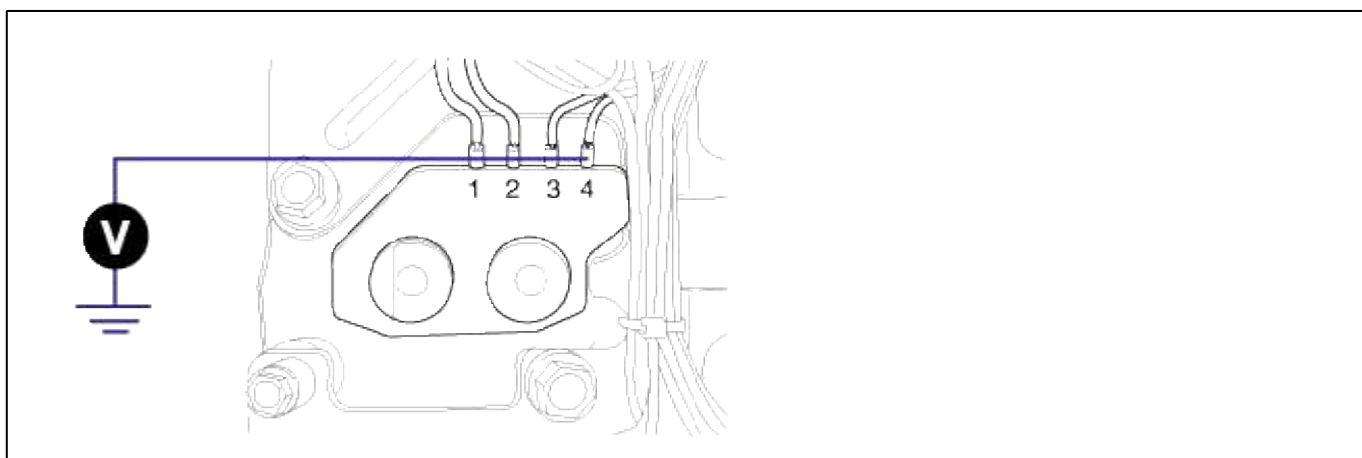
**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
If signal circuit in harness is OK, Go to "Check TCM" of the "Component Inspection" procedure.

Power supply circuit inspection

1. Remove "OIL PAN".
2. Ignition "ON", Engine "OFF".
3. Connect the "C106-3 and Shift CM" connector.
4. Measure resistance between terminal "4" of the TURBINE SENSOR harness connector and chassis ground.

Specification : approx. 12V



5. Is voltage within specifications ?

**YES**

Go to "Ground circuit inspection" procedure.

**NO**

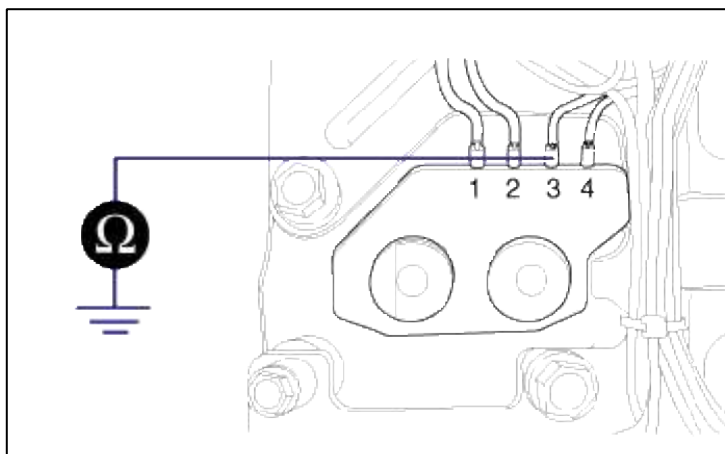
Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
If power circuit in harness is OK, Substitute with a known-good Shift CM and check for proper operation. If the problem is corrected, replace Shift CM as necessary and go to "Verification of Vehicle Repair" procedure.

Ground circuit inspection

1. Remove "OIL PAN".
2. Engine "OFF".
3. Disconnect the "C106-3 and Shift CM" connector.

4. Measure resistance between terminal "3" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx.  $0\Omega$



5. Is resistance within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for open in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Check "TURBINE SENSOR 2"

(1) Ignition "ON" & Engine "OFF".

(2) Connect the "C106-3" connector.

(3) Measure Frequency between terminal "6" of the C106-3 harness connector and chassis ground.

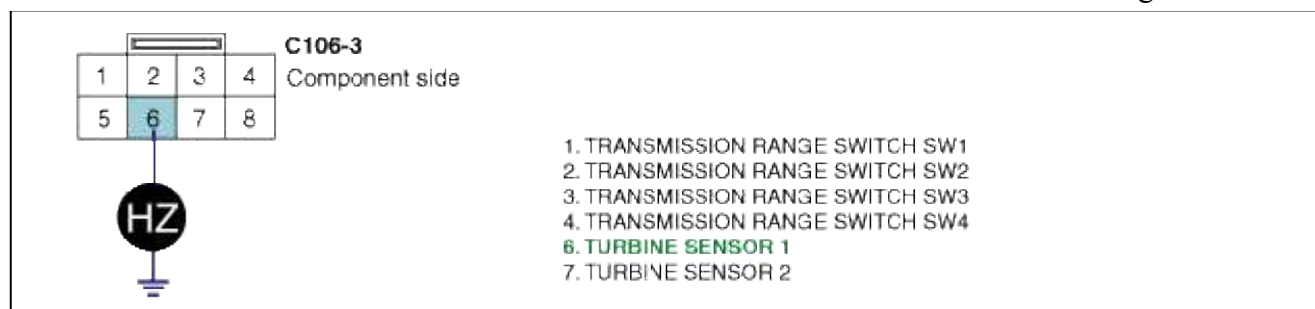
Specification :

NAME	PIN NO	Measurement condition	Spec
Turbine Sensor1	6	<ul style="list-style-type: none"> <li>• 1st gear</li> <li>• 12.42MPH(20km/h)</li> <li>• Idle SW OFF</li> </ul>	Approx. 1.1K
Turbine Sensor2	7	<ul style="list-style-type: none"> <li>• 4th gear</li> <li>• 31MPH(50km/h)</li> <li>• Idle SW OFF</li> </ul>	

### CAUTION

Scan tool data link cable is maintain to connecting condition.





(4) Is frequency within specifications?

**YES**

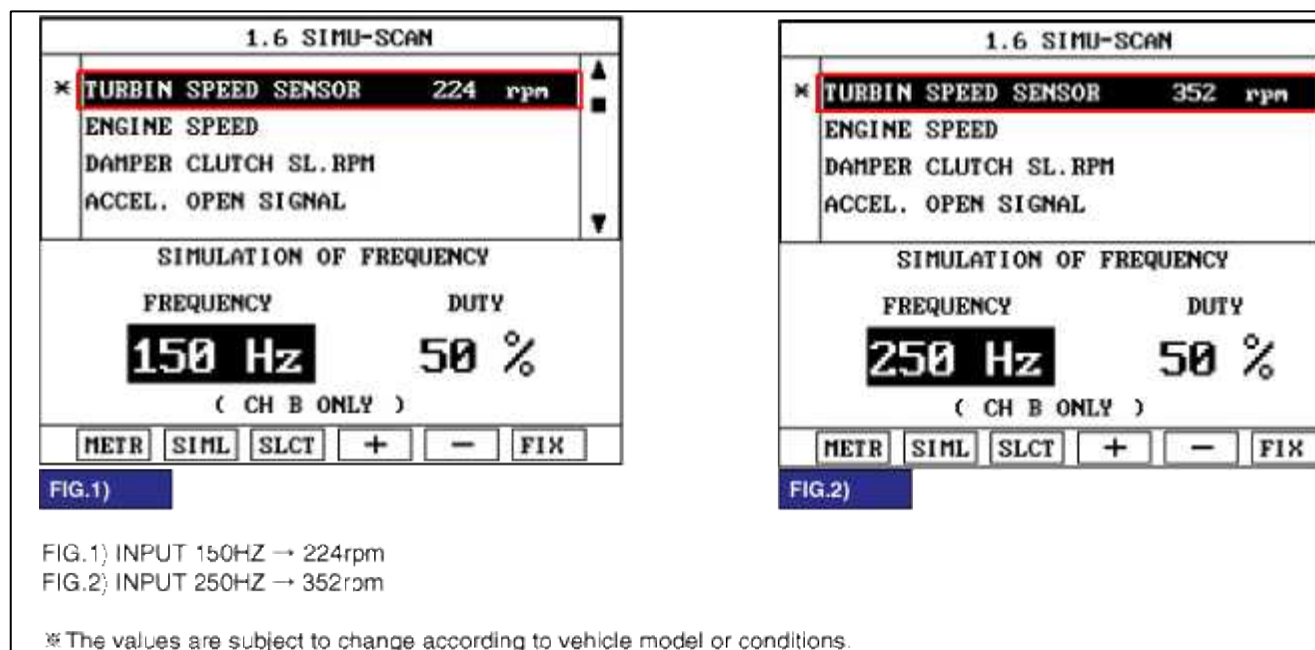
Go to "CHECK TCM " as below.

**NO**

Replace "TURBINE SENSOR" as necessary and Go to "Verification of Vehicle Repair" procedure.

## 2. CHECK TCM

- (1) Ignition "ON" & Engine "OFF".
- (2) Disconnect "C106-3" connector.
- (3) Install scantool and access "SIMU-SCAN" mode.
- (4) Simulate frequency to TURBINE SENSOR 1 signal circuit.



(5) Is "TURBINE SENSOR 1" signal value changed according to simulation frequency?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorated damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace T as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.



4. Are any DTCs present?

**YES**

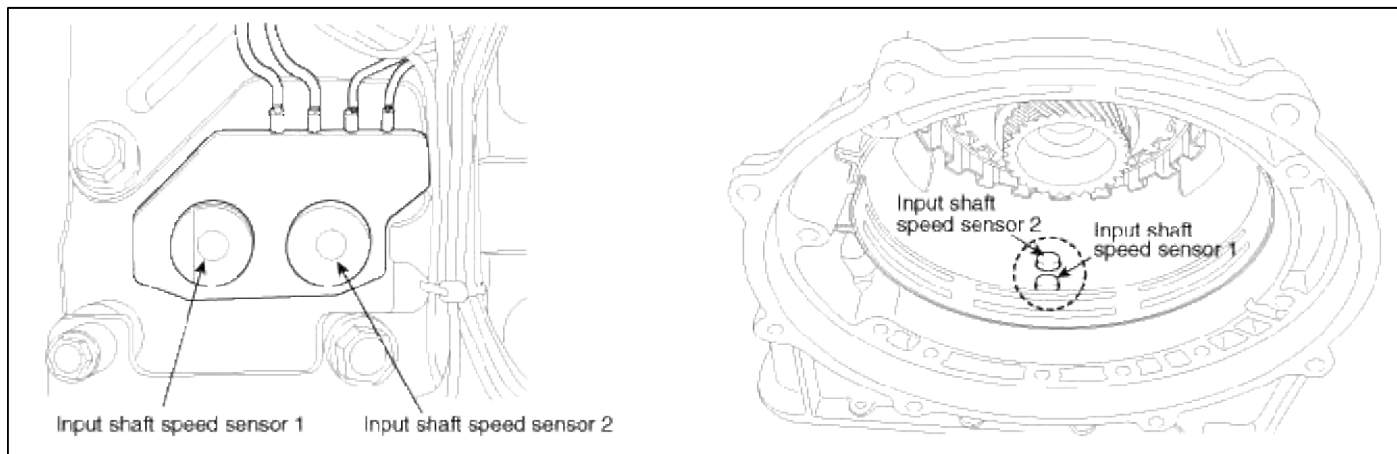
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Automatic Transaxle System > Troubleshooting > P0717

#### COMPONENT LOCATION



#### GENERAL DESCRIPTION

The Input Sensor of RXC Auto transmission is composed of S1(Sensor1) and S2(Sensor2). S1 inputs signal to TCM only at 4th gear and S2 does at 1st, 2nd, 3rd, 4th and 5th gear. Therefore, sensing pulse frequency generated by both signals, TCM calculates Inputshaft speed and compute Turbine rotation. This value is mainly used to control the optimum fluid pressure during shifting.

#### DTC DESCRIPTION

The TCM sets this code if an output pulse-signal is not detected, from the INPUT SPEED SENSOR 1 or 2, when the vehicle is running faster than 5MPH(8km/h). The Fail-Safe function will be set by the TCM if this code is detected.

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• Speed rationality check</li> </ul>	<ul style="list-style-type: none"> <li>• Signal circuit is open or short</li> <li>• Sensor power circuit is open</li> <li>• Sensor ground circuit is open</li> <li>• Faulty INPUT SPEED SENSOR 1</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Battery voltage &gt; 10V</li> <li>• Output speed &gt; 1000rpm</li> <li>• Engine speed(Only current gear is the 1st gear) &gt; 3000 rpm</li> <li>• Engine speed(2.3.4.5 gear) &gt; 700 rpm</li> <li>• Position lever = "D"</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Input speed1 <math>\leq</math> 100rpm</li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• More than 2sec</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• "Input speed" is regarded as 600rpm(Nt = 600rpm)</li> <li>• Shift prevention over 4th gear</li> <li>• Prevention of manual shift</li> <li>• Prevention of pressure adaptation</li> </ul>	

#### Monitor Scantool Data

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "INPUT SPEED SENSOR 1" parameter on the scantool.
4. Driving at speed of over 12.42MPH(20km/h) at 1 gear.

---

Specification : Increasing Gradually

---

1.11 CURRENT DATA 81/59	
× ENGINE SPEED	786 rpm
× INPUT SPEED(PG-A)	658.8rpm
× TURBIN SPEED SENDOR 1	0.0 rpm
× TURBIN SPEED SENDOR 2	628.8rpm
× TCC SLIP RPM	25.0 rpm
× CURRENT GEAR POSITION	P N
× SELECTED LEVER RANGE	P
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

FIG.1)

1.11 CURRENT DATA 81/59	
× ENGINE SPEED	661 rpm
× INPUT SPEED(PG-A)	0.0 rpm
× TURBIN SPEED SENDOR 1	0.0 rpm
× TURBIN SPEED SENDOR 2	0.0 rpm
× TCC SLIP RPM	658.8rpm
× CURRENT GEAR POSITION	REVERSE
× SELECTED LEVER RANGE	R
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

FIG.2)

1.11 CURRENT DATA 81/59	
× ENGINE SPEED	656 rpm
× INPUT SPEED(PG-A)	0.0 rpm
× TURBIN SPEED SENDOR 1	0.0 rpm
× TURBIN SPEED SENDOR 2	0.0 rpm
× TCC SLIP RPM	654.8rpm
× CURRENT GEAR POSITION	1 GEAR
× SELECTED LEVER RANGE	D
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

FIG.3)

1.11 CURRENT DATA 81/59	
× ENGINE SPEED	1927 rpm
× INPUT SPEED(PG-A)	1898.rpm
× TURBIN SPEED SENDOR 1	0.0 rpm
× TURBIN SPEED SENDOR 2	1887.rpm
× TCC SLIP RPM	14.0 rpm
× CURRENT GEAR POSITION	1 GEAR
× SELECTED LEVER RANGE	D
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

FIG.4)

1.11 CURRENT DATA 81/59	
× ENGINE SPEED	1805 rpm
× INPUT SPEED(PG-A)	1862.rpm
× TURBIN SPEED SENDOR 1	0.0 rpm
× TURBIN SPEED SENDOR 2	1857.rpm
× TCC SLIP RPM	26.0 rpm
× CURRENT GEAR POSITION	2 GEAR
× SELECTED LEVER RANGE	D
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

FIG.5)

1.11 CURRENT DATA 81/59	
× ENGINE SPEED	2140 rpm
× INPUT SPEED(PG-A)	2116.rpm
× TURBIN SPEED SENDOR 1	0.0 rpm
× TURBIN SPEED SENDOR 2	2079.rpm
× TCC SLIP RPM	32.0 rpm
× CURRENT GEAR POSITION	3 GEAR
× SELECTED LEVER RANGE	D
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

FIG.6)

1.11 CURRENT DATA 81/59	
× ENGINE SPEED	1987 rpm
× INPUT SPEED(PG-A)	1986.rpm
× TURBIN SPEED SENDOR 1	1838.rpm
× TURBIN SPEED SENDOR 2	3822.rpm
× TCC SLIP RPM	0.0 rpm
× CURRENT GEAR POSITION	4 GEAR
× SELECTED LEVER RANGE	D
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

FIG.7)

1.11 CURRENT DATA 81/59	
× ENGINE SPEED	2830 rpm
× INPUT SPEED(PG-A)	2848.rpm
× TURBIN SPEED SENDOR 1	0.0 rpm
× TURBIN SPEED SENDOR 2	2872.rpm
× TCC SLIP RPM	0.0 rpm
× CURRENT GEAR POSITION	5 GEAR
× SELECTED LEVER RANGE	D
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

FIG.8)

FIG.1) "P,N" range

FIG.2) "R" range

FIG.3) "D" range 1st gear, vehicle speed = 0

FIG.4) "D" range 1st gear

FIG.5) "D" range 2nd gear

FIG.6) "D" range 3rd gear

FIG.7) "D" range 4th gear

FIG.8) "D" range 5th gear

5. Does "INPUT SPEED SENSOR" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

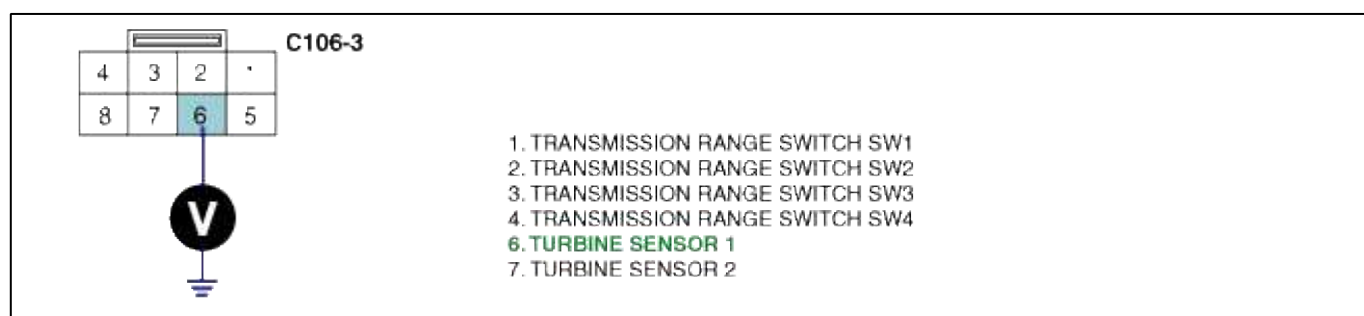
## SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "C106-3" connector.
3. Measure voltage between terminal "6" of the C106-3 harness connector and chassis ground.

---

Specification : Approx. 5 V

---



4. Is voltage within specifications?

**YES**

Go to "Power supply circuit inspection" procedure.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.

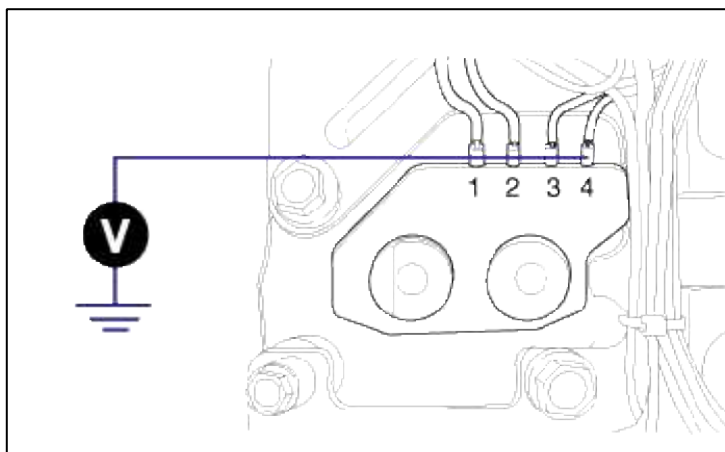
If signal circuit in harness is OK, Go to "Check TCM" of the "Component Inspection" procedure.

## Power supply circuit inspection

1. Remove "OIL PAN".
2. Ignition "ON", Engine "OFF".
3. Connect the "C106-3 and Shift CM" connector.

4. Measure resistance between terminal "4" of the TURBINE SENSOR harness connector and chassis ground.

Specification : approx. 12V



5. Is voltage within specifications ?

**YES**

Go to "Ground circuit inspection" procedure.

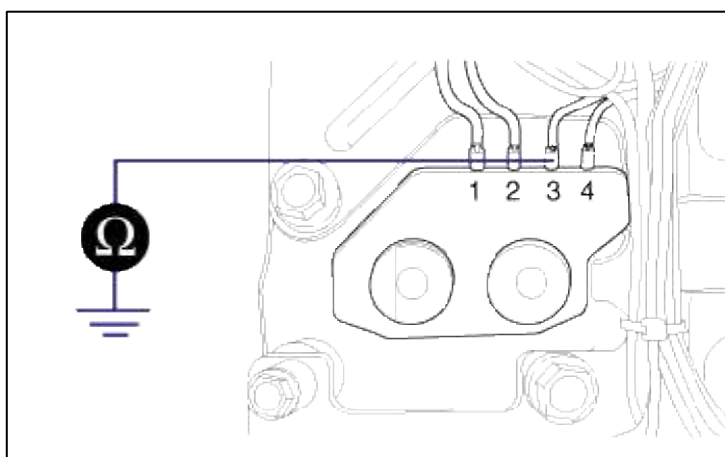
**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If power circuit in harness is OK, Substitute with a known-good Shift CM and check for proper operation. If the problem is corrected, replace Shift CM as necessary and go to "Verification of Vehicle Repair" procedure.

#### Ground circuit inspection

1. Remove "OIL PAN".
2. Engine "OFF".
3. Disconnect the "C106-3 and Shift CM" connector.
4. Measure resistance between terminal "3" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0Ω



5. Is resistance within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for open in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION

## 1. Check "TURBINE SENSOR 2"

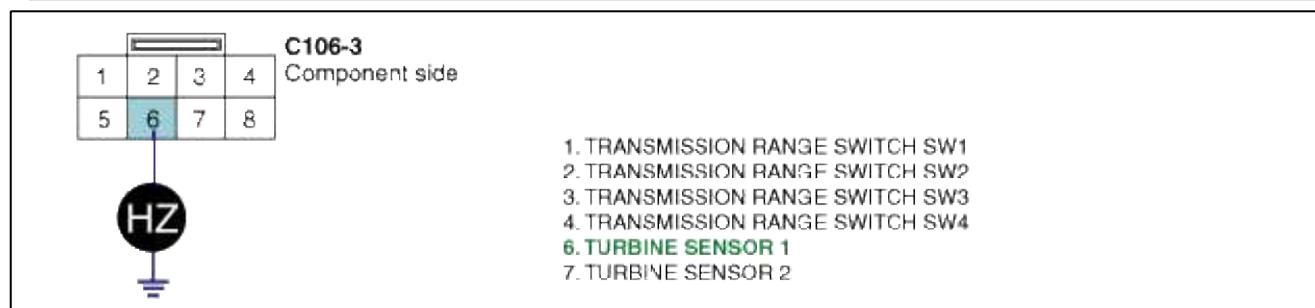
- (1) Ignition "ON" & Engine "OFF".
- (2) Connect the "C106-3" connector.
- (3) Measure Frequency between terminal "6" of the C106-3 harness connector and chassis ground.

Specification :

NAME	PIN NO	Measurement condition	Spec
Turbine Sensor1	6	<ul style="list-style-type: none"> <li>• 1st gear</li> <li>• 12.42MPH(20km/h)</li> <li>• Idle SW OFF</li> </ul>	Approx. 1.1K
Turbine Sensor2	7	<ul style="list-style-type: none"> <li>• 4th gear</li> <li>• 31MPH(50km/h)</li> <li>• Idle SW OFF</li> </ul>	

**CAUTION**

Scan tool data link cable is maintain to connecting condition.



## (4) Is frequency within specifications?

**YES**

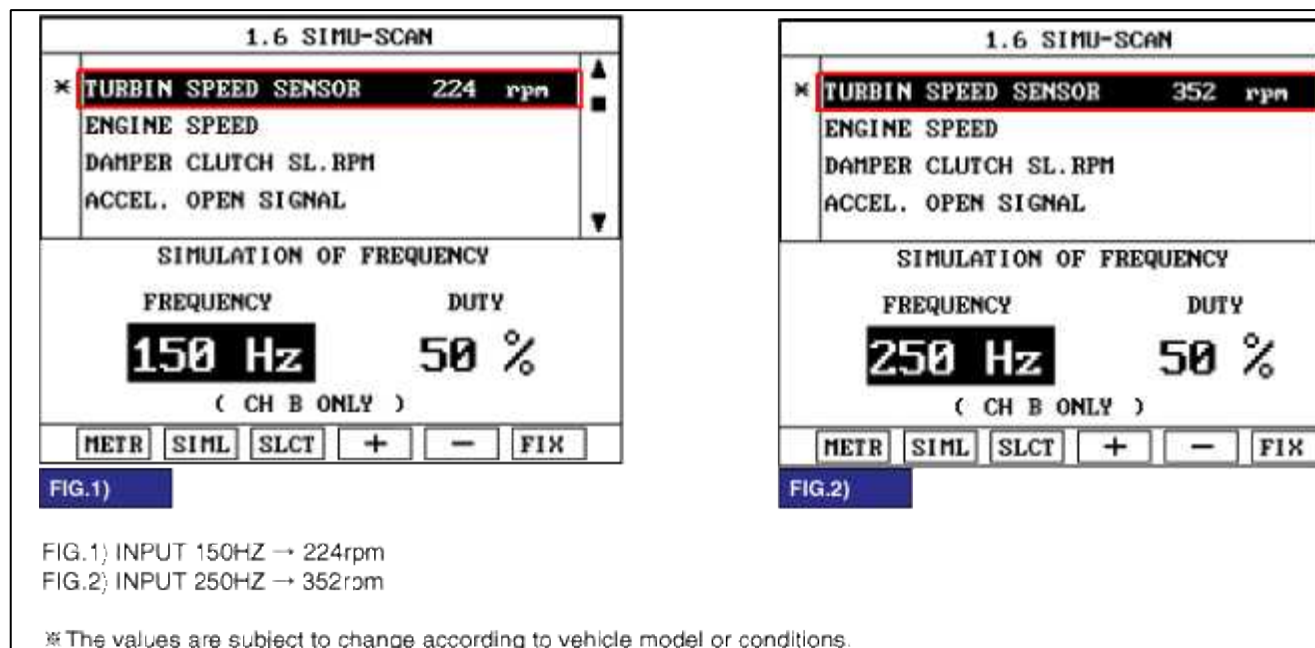
Go to "CHECK TCM " as below.

**NO**

Replace "TURBINE SENSOR" as necessary and Go to "Verification of Vehicle Repair" procedure.

## 2. CHECK TCM

- (1) Ignition "ON" & Engine "OFF".
- (2) Disconnect "C106-3" connector.
- (3) Install scantool and access "SIMU-SCAN" mode.
- (4) Simulate frequency to TURBINE SENSOR 1 signal circuit.



- (5) Is "TURBINE SENSOR 1" signal value changed according to simulation frequency?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorated damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace T as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

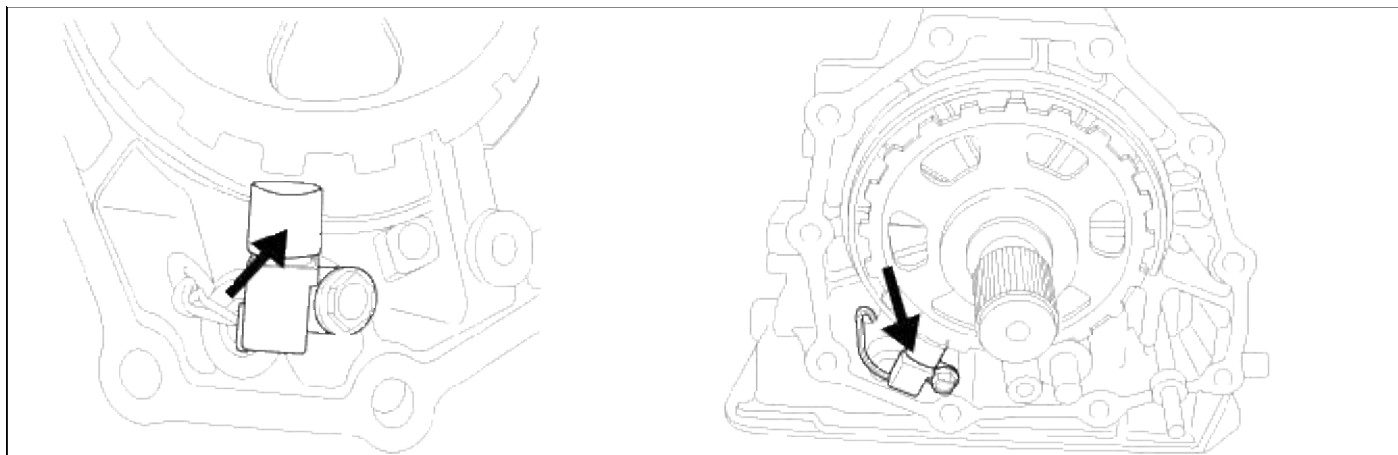
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > P0721

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The OUTPUT SPEED SENSOR outputs waveform signals according to the revolutions of the output shaft of the transmission. The Output Speed Sensor is installed in front of the Parking Gear to determine the Parking Gear rpms by counting the frequency of the pulses. This value, together with the throttle position data, is mainly used to decide the optimum gear position.

### DTC DESCRIPTION

The TCM sets this code if the calculated value of the signals is noticeably different from the value calculated, using the Vehicle Speed Sensor output, when the vehicle is running faster than 15.6MPH(25km/h). The TCM will initiate the fail safe function if this code is detected.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• Speed rationality check</li> </ul>	<ul style="list-style-type: none"> <li>• Signal circuit is open or short</li> <li>• Sensor power circuit is open</li> <li>• Sensor ground circuit is open</li> <li>• Faulty OUTPUT SPEED SENSOR</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Battery voltage &gt; 10V</li> <li>• Lever position = "D"</li> <li>• Engine speed &gt; 3000 rpm</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Output speed = 0 rpm</li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• More than 4sec</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• Shift prevention over 4th gear</li> <li>• Prevention of manual shift</li> <li>• Prevention of pressure adaptation</li> <li>• Output speed from vehicle speed</li> </ul>	

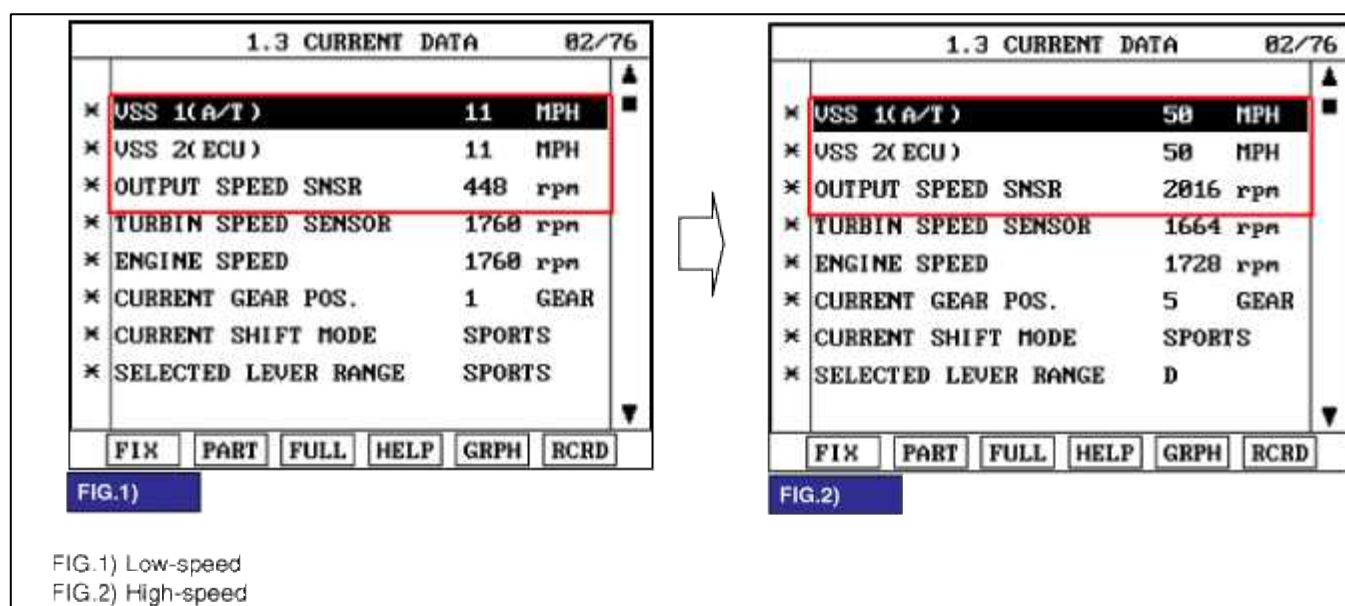
### Monitor Scantool Data

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "OUTPUT SPEED SENSOR" parameter on the scantool.



## 4. Driving at speed of over 5km/h.

Specification : Increasing Gradually



## 5. Does "OUTPUT SPEED SENSOR" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

## TERMINAL &amp; CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

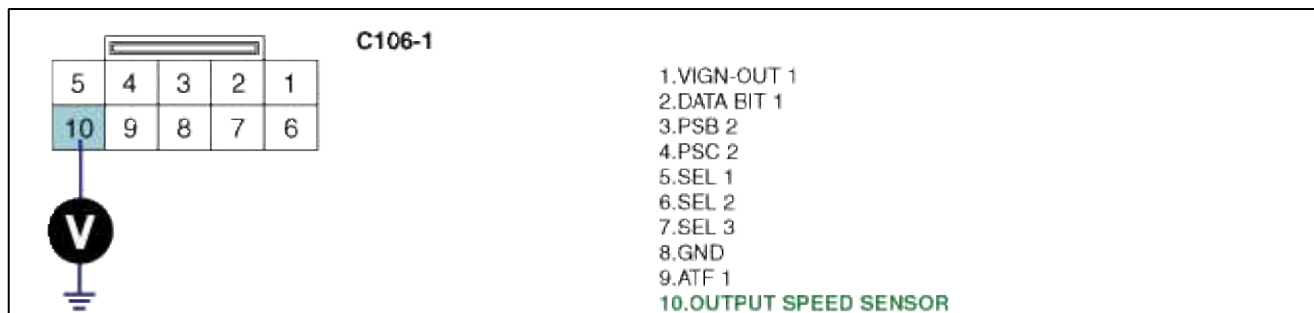
Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

## 1. CHECK "OUTPUT SPEED SENSOR SIGNAL CIRCUIT 1"

- (1) Ignition "ON" & Engine "OFF".
- (2) Disconnect the "C106-1" connector.
- (3) Measure voltage between terminal "10" of the C106-1 harness connector and chassis ground.

Specification : approx. 5V



- (4) Is voltage within specifications?

**YES**

Go to "OUTPUT SPEED SENSOR SIGNAL CIRCUIT 2" as below.

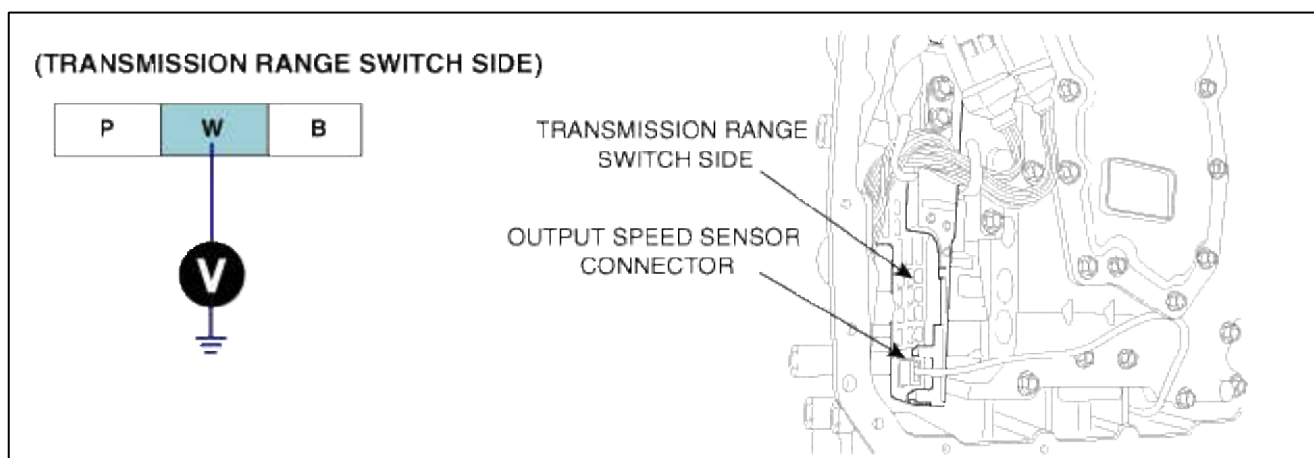
**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
If signal circuit in harness is OK, Go to "Component Inspection" procedure.

## 2. CHECK "OUTPUT SPEED SENSOR SIGNAL CIRCUIT 2"

- (1) Remove "OIL PAN".
- (2) Connect the "C106-1" connector.
- (3) Ignition "ON" & Engine "OFF".
- (4) Disconnect the "OUTPUT SPEED SENSOR" connector.
- (5) Measure voltage between terminal "WHITE COLOR" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 5V



(6) Is voltage within specifications?

**YES**

Go to "Power supply circuit inspection" procedure.

**NO**

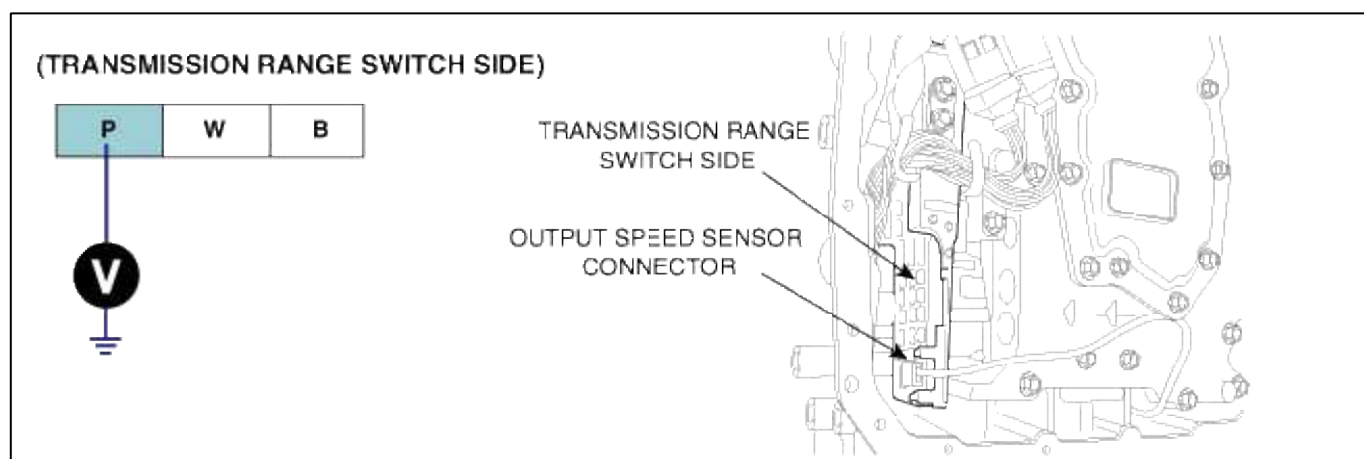
Check for open or short in harness(H-02[A]~TRANSMISSION RANGE SWITCH). Repair as necessary.  
Go to "Verification of Vehicle Repair" procedure.

If signal circuit in harness is OK, Replace "TRANSMISSION RANGE SWITCH" as necessary and Go to "Verification of Vehicle Repair" procedure.

#### Power supply circuit inspection

1. Remove "OIL PAN".
2. Connect the "C106-1" connector.
3. Ignition "ON" & Engine "OFF".
4. Disconnect the "OUTPUT SPEED SENSOR" connector.
5. Measure voltage between terminal "PINK COLOR" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 12V



6. Is voltage within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

**NO**

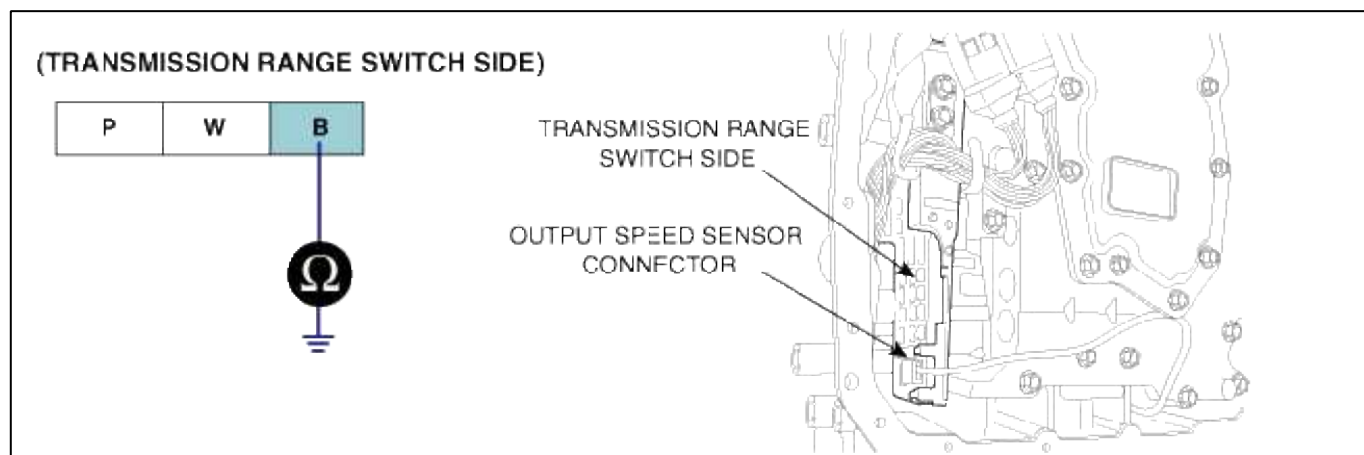
Replace "TRANSMISSION RANGE SWITCH" as necessary and Go to "Verification of Vehicle Repair" procedure.

#### Ground circuit inspection

1. Ignition "OFF" & Engine "OFF".
2. Remove "OIL PAN".
3. Connect the "C106-1" connector.
4. Disconnect the "OUTPUT SPEED SENSOR" connector.

5. Measure resistance between terminal "BLACK COLOR" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx.  $0\Omega$



6. Is resistance within specifications?

**YES**

Substitute with a known-good "OUTPUT SPEED SENSOR" and check for proper operation. If the problem is corrected, replace "OUTPUT SPEED SENSOR" as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Replace "TRANSMISSION RANGE SWITCH" as necessary and Go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### CHECK TCM

1. Ignition "ON" & Engine "OFF".
2. Disconnect "C106-1" connector.
3. Install scantool and access "SIMU-SCAN" mode.
4. Simulate frequency to OUTPUT SPEED SENSOR signal circuit.

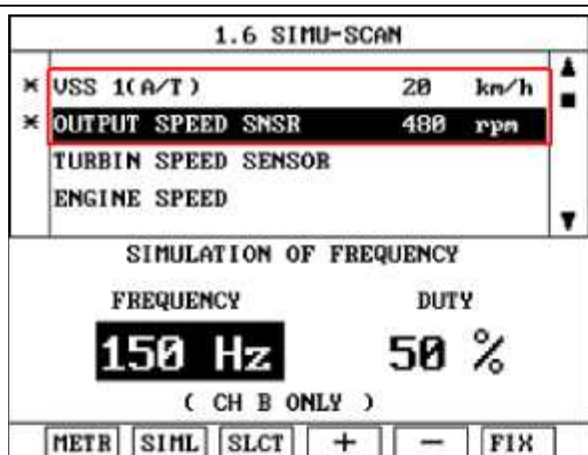


FIG.1)

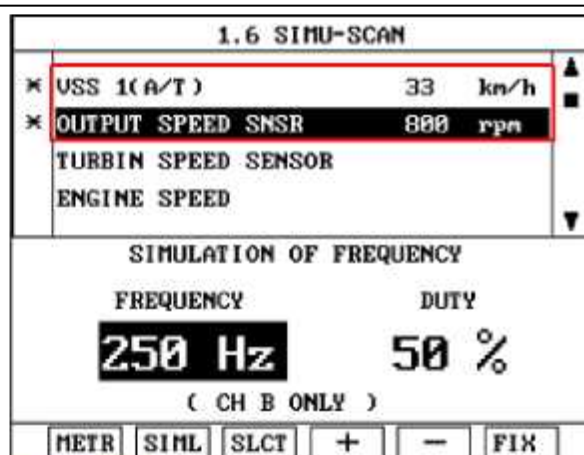


FIG.2)

FIG.1) INPUT 150HZ → 480rpm

FIG.2) INPUT 250HZ → 800rpm

※ The values are subject to change according to vehicle model or conditions.

5. Is "OUTPUT SPEED SENSOR" signal value changed according to simulation frequency?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

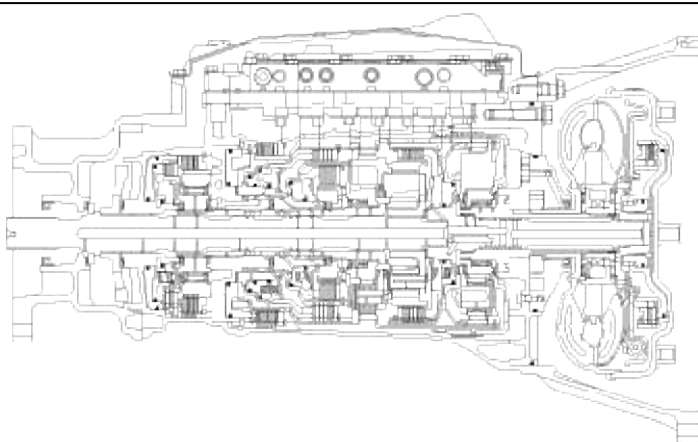
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > P0731

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 1st gear ratio, while the transaxle is engaged in the 1st gear. For example, if the output speed is 1000 rpm and the 1st gear ratio is 3.827, then the input speed is 3827 rpm.

### DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 1st gear ratio, while the transaxle is engaged in 1st gear.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• 1st gear incorrect ratio</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty input speed sensor</li> <li>• Faulty output speed sensor</li> <li>• Faulty internal transmission</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Engine speed &gt;600rpm</li> <li>• 150rpm &gt;Output speed &lt; 6000rpm</li> <li>• Lever Position = "D"</li> <li>• Input speed &gt; 600rpm</li> <li>• A/T oil temp output <math>\geq -10^{\circ}\text{C}</math></li> <li>• Throttle opening &gt;15%</li> <li>• The time after the last shift was finish &gt;1sec</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Input speed - output speed <math>\times</math> 1st gear ratio <math>\geq 200\text{rpm}</math></li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• More than 1sec</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• 4th gear Limp-Home mode</li> </ul>	

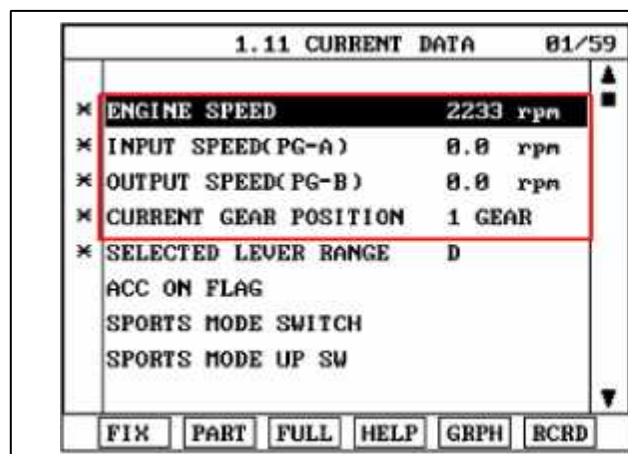
### MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "1"

---

Specification :  $2300 \pm 200$  engine rpm

---



### OPERATING ELEMENT OF EACH SHIFTING RANGE

Shifting Position	Input clutch	High&Low Reverse Clutch	Direct clutch	Reverse Brake	Front Brake	Low Coast Brake	Forward Brake	1st OwnWayClutch	Forward OwnWayClutch	3rd OwnWayClutch
P		▲			▲					
R		●		●	●			●		●
N		▲			▲	★				
D	1st gear	★			▲		●	●	●	●
	2nd gear		●		▲		●		●	●
	3rd gear	●	●		●		▲	◆		●
	4th gear	●	●				▲	◆		
	5th gear	●	●		●		▲	◆		◆

● : WORKING.  
 ◆ : PARTICIPATE IN DELIVERY TORQUE WHEN COAST DRIVING.  
 ▲ : SUPPLING OIL PRESSURE TO ELEMENT, BUT NOT EFFECT ON OUTPUT.  
 ★ : TEMPORARY WORKING.

### Stall test procedure in D1 and reason

#### Procedure

A. Warm up the engine

B. After positioning the select lever in "D", depress the foot brake pedal fully. After that, depress the accelerator pedal to the maximum

\* The slippage of 1st gear operating parts can be detected by stall test in D

#### Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in the torque converter.

B. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock

C. If 1st gear operating parts have faults, input speed revolution will be out of specification.

D. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specification?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Go to "Component inspection" procedure.

#### CAUTION

- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
- Check the A/T fluid level and temperature and the engine coolant temperature.
  - Fluid level : At the hot mark on the oil level gauge.
  - Fluid temperature : 176 °F~ 212 °F (80~100 °C).
  - Engine coolant temperature : 176 °F~ 212 °F (80~100 °C).
- Chock both rear wheels(left and right).
- Pull the parking brake lever on with the brake pedal fully depressed.
- The throttle should not be left fully open for more than eight seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.

### SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.

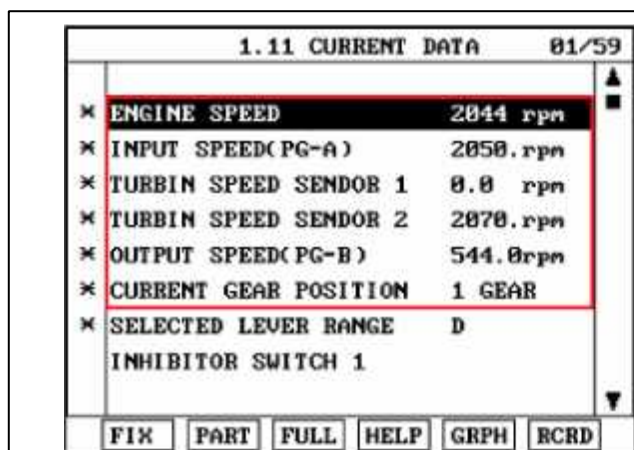
2. Engine "ON".

3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.



4. Accelerate the Engine speed until about 2000 rpm in the 1st gear.

Specification :  $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times \text{1st GEAR RATIO}) \leq 200 \text{ RPM}$



5. Does "INPUT&OUTPUT SPEED SENSOR" within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

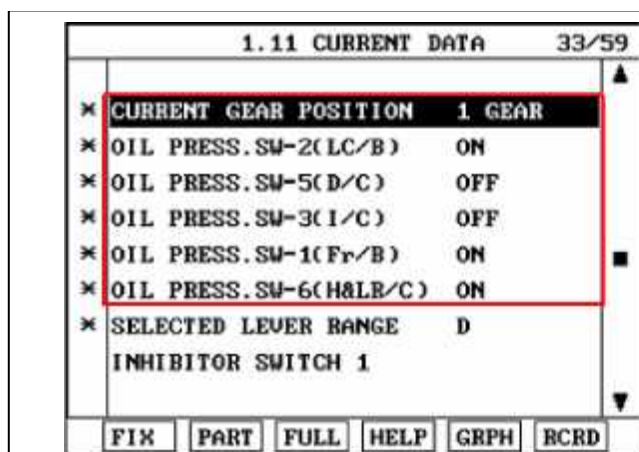
Check condition of Input & Output Speed Sensor and sensor wiring. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "OIL PRESSURE. S/W 1,2,3,5,6" parameter on the scantool.
4. Move select lever to "D" range and operate vehicle within 1st gear condition.

Shift position		Oil Pressure Switch				
		I/C(SW3)	H&LR/C(SW6)	H&LR/C(SW6)	FR/B(SW1)	LC/B(SW2)
P		X	O	X	O	X
R		X	O	X	O	X
N		X	O	X	O	X
D	1st gear	X	X	X	O	X
	2nd gear	X	X	O	O	X
	3rd gear	X	O	O	O	X
	4th gear	O	O	O	X	X
	5th gear	O	O	X	O	X





5. Does "OIL PRESSURE. S/W 1,2,3,5,6 " follow the reference data?

**YES**

Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification of Vehicle Repair" procedure.

**NO**

Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification of Vehicle Repair " procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present ?

**YES**

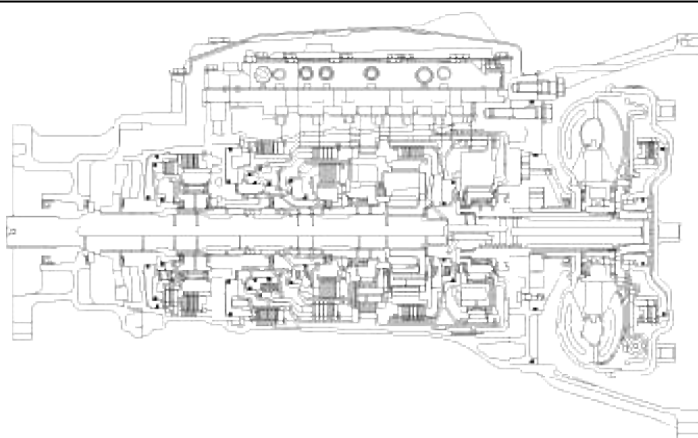
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > P0732

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 2nd

gear ratio, while the transaxle is engaged in the 2nd gear. For example, if the output speed is 1000 rpm and the 2nd gear ratio is 2.368, then the input speed is 2368 rpm.

### DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 2nd gear ratio, while the transaxle is engaged in 2nd gear.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• 2nd gear incorrect ratio</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty input speed sensor</li> <li>• Faulty output speed sensor</li> <li>• Faulty internal transmission</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Engine speed &gt;600rpm</li> <li>• 150rpm &gt; Output speed &lt; 6000rpm</li> <li>• Lever Position = "D"</li> <li>• Input speed &gt; 600rpm</li> <li>• A/T oil temp output <math>\geq -10^{\circ}\text{C}</math></li> <li>• Throttle opening &gt;15%</li> <li>• The time after the last shift was finish &gt;1sec</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Input speed - output speed <math>\times</math> 2nd gear ratio <math>\geq 200\text{rpm}</math></li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• More than 1sec</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• 4th gear Limp-Home mode</li> </ul>	

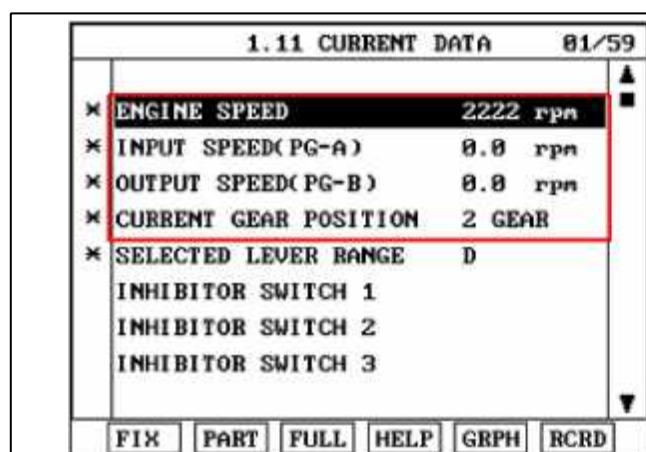
### MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "2"

---

Specification :  $2300 \pm 200$  engine rpm

---



### OPERATING ELEMENT OF EACH SHIFTING RANGE

Shifting Position	Input clutch	High&Low Reverse Clutch	Direct clutch	Reverse Brake	Front Brake	Low Coast Brake	Forward Brake	1st OwnWayClutch	Forward OwnWayClutch	3rd OwnWayClutch
P		▲			▲					
R		●		●	●			●		●
N		▲			▲	★				
D	1st gear	★			▲		●	●	●	●
	2nd gear		●		▲		●		●	●
	3rd gear	●	●		●		▲	◆		●
	4th gear	●	●				▲	◆		
	5th gear	●	●		●		▲	◆		◆

● : WORKING.

◆ : PARTICIPATE IN DELIVERY TORQUE WHEN COAST DRIVING.

▲ : SUPPLING OIL PRESSURE TO ELEMENT, BUT NOT EFFECT ON OUTPUT.

★ : TEMPORARY WORKING.

### Stall test procedure in D2 and reason

#### Procedure

A. Warm up the engine

B. After positioning the select lever in "D", depress the foot brake pedal fully. After that, depress the accelerator pedal to the maximum

\* The slippage of 2nd gear operating parts can be detected by stall test in D2

#### Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in the torque converter.

B. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock

C. If 2nd gear operating parts have faults, input speed revolution will be out.

D. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specification?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Go to "Component inspection" procedure.

#### CAUTION

- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
- Check the A/T fluid level and temperature and the engine coolant temperature.
  - Fluid level : At the hot mark on the oil level gauge.
  - Fluid temperature : 176 °F~ 212 °F (80~100 °C).
  - Engine coolant temperature : 176 °F~ 212 °F (80~100 °C).
- Chock both rear wheels(left and right).
- Pull the parking brake lever on with the brake pedal fully depressed.
- The throttle should not be left fully open for more than eight seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.

### SIGNAL CIRCUIT INSPECTION

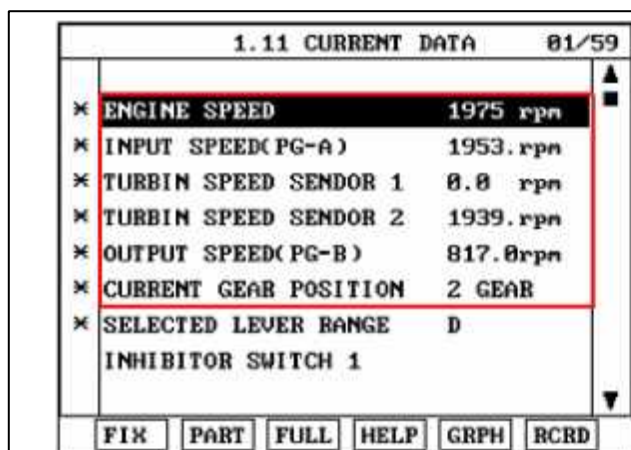
1. Connect Scantool.

2. Engine "ON".

3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.

4. Accelerate the Engine speed until about 2000 rpm in the 2nd gear.

Specification :  $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times 2\text{nd GEAR RATIO}) \leq 200 \text{ RPM}$



5. Does "INPUT&OUTPUT SPEED SENSOR" within specifications?

**YES**

Go to "Component Inspection" procedure.

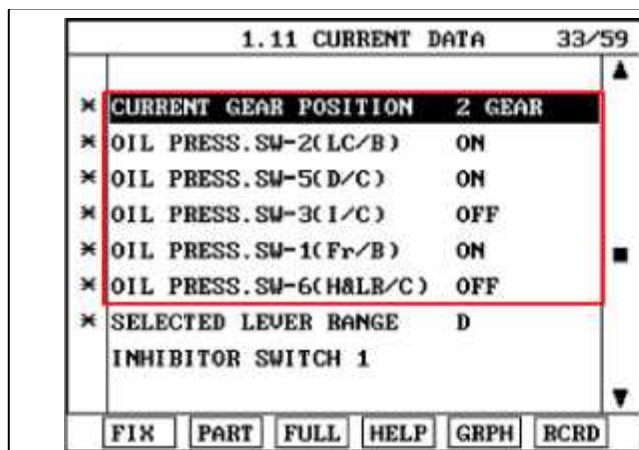
**NO**

Check condition of Input & Output Speed Sensor and sensor wiring. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "OIL PRESSURE. S/W 1,2,3,5,6" parameter on the scantool.
4. Move select lever to "D" range and operate vehicle within 2nd gear condition.

Shift position		Oil Pressure Switch				
		I/C(SW3)	H&LR/C(SW6)	H&LR/C(SW6)	FR/B(SW1)	LC/B(SW2)
P		X	O	X	O	X
R		X	O	X	O	X
N		X	O	X	O	X
D	1st gear	X	X	X	O	X
	2nd gear	X	X	O	O	X
	3rd gear	X	O	O	O	X
	4th gear	O	O	O	X	X
	5th gear	O	O	X	O	X



5. Is oil pressure value within specifications?

**YES**

Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification of Vehicle Repair" procedure.

**NO**

Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification of Vehicle Repair " procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present ?

**YES**

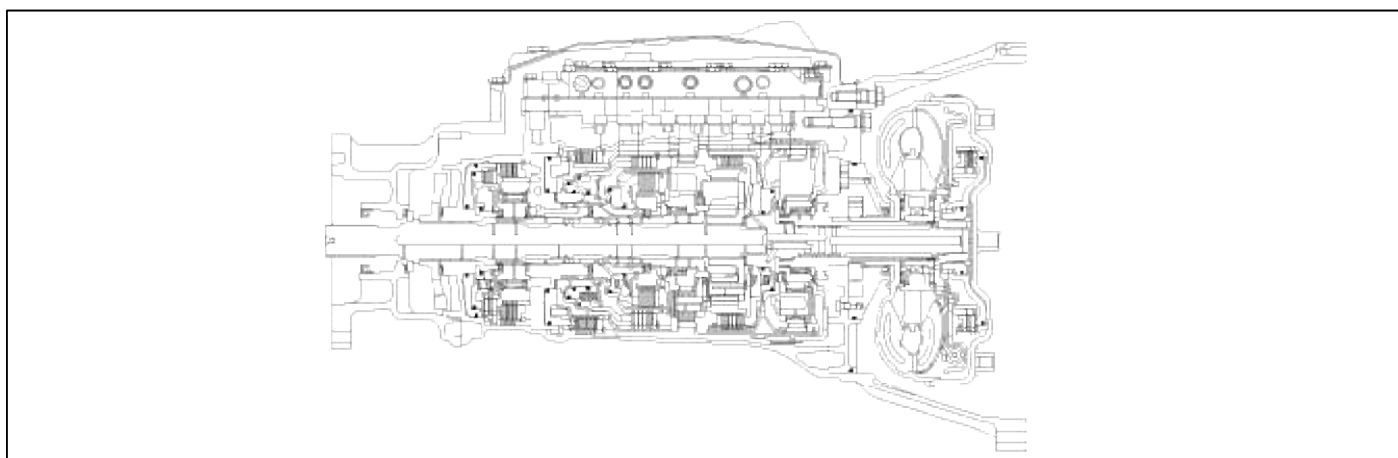
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

#### Automatic Transaxle System > Troubleshooting > P0733

##### COMPONENT LOCATION



##### GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 3rd

gear ratio, while the transaxle is engaged in the 3rd gear. For example, if the output speed is 1,000 rpm and the 3rd gear ratio is 1.520, then the input speed is 1520 rpm.

### DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 3rd gear ratio, while the transaxle is engaged in 3rd gear.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• 3rd gear incorrect ratio</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty input speed sensor</li> <li>• Faulty output speed sensor</li> <li>• Faulty internal transmission</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Engine speed &gt;600rpm</li> <li>• 150rpm &gt; Output speed &lt; 6000rpm</li> <li>• Lever Position = "D"</li> <li>• Input speed &gt; 600rpm</li> <li>• A/T oil temp output <math>\geq -10^{\circ}\text{C}</math></li> <li>• Throttle opening &gt;15%</li> <li>• The time after the last shift was finish &gt;1sec</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Input speed - output speed <math>\times</math> 3rd gear ratio <math>\geq 200\text{rpm}</math></li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• More than 1sec</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• 4th gear Limp-Home mode</li> </ul>	

### SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 3rd gear.

---

Specification :  $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times 3\text{rd GEAR RATIO}) \leq 200 \text{ RPM}$

---

1.11 CURRENT DATA 01/59	
× ENGINE SPEED	2015 rpm
× INPUT SPEED(PG-A)	1996 rpm
× TURBIN SPEED SENDOR 1	0.8 rpm
× TURBIN SPEED SENDOR 2	1998 rpm
× OUTPUT SPEED(PG-B)	1311 rpm
× CURRENT GEAR POSITION	3 GEAR
× SELECTED LEVER RANGE	D
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

5. Does "INPUT&OUTPUT SPEED SENSOR" within specifications?

**YES**

Go to "Component Inspection" procedure.

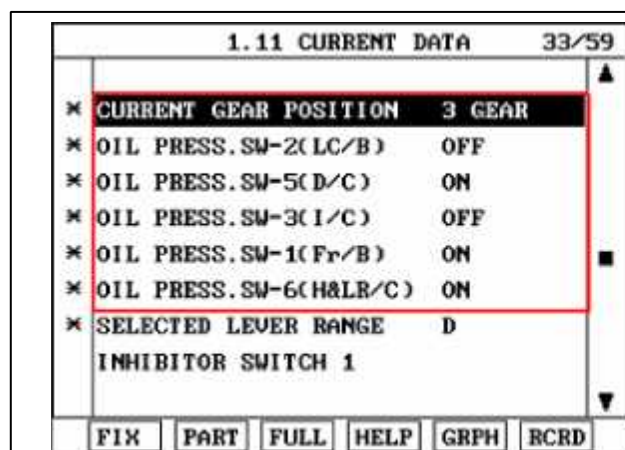
**NO**

Check condition of Input & Output Speed Sensor and sensor wiring. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "OIL PRESSURE. S/W 1,2,3,5,6" parameter on the scantool.
4. Move select lever to "D" range and operate vehicle within 3rd gear condition.

Shift position		Oil Pressure Switch				
		I/C(SW3)	H&LR/C(SW6)	H&LR/C(SW6)	FR/B(SW1)	LC/B(SW2)
P		X	O	X	O	X
R		X	O	X	O	X
N		X	O	X	O	X
D	1st gear	X	X	X	O	X
	2nd gear	X	X	O	O	X
	3rd gear	X	O	O	O	X
	4th gear	O	O	O	X	X
	5th gear	O	O	X	O	X



5. Is oil pressure value within specifications?

**YES**

Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification of Vehicle Repair" procedure.

**NO**

Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.



2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present ?

**YES** ☐

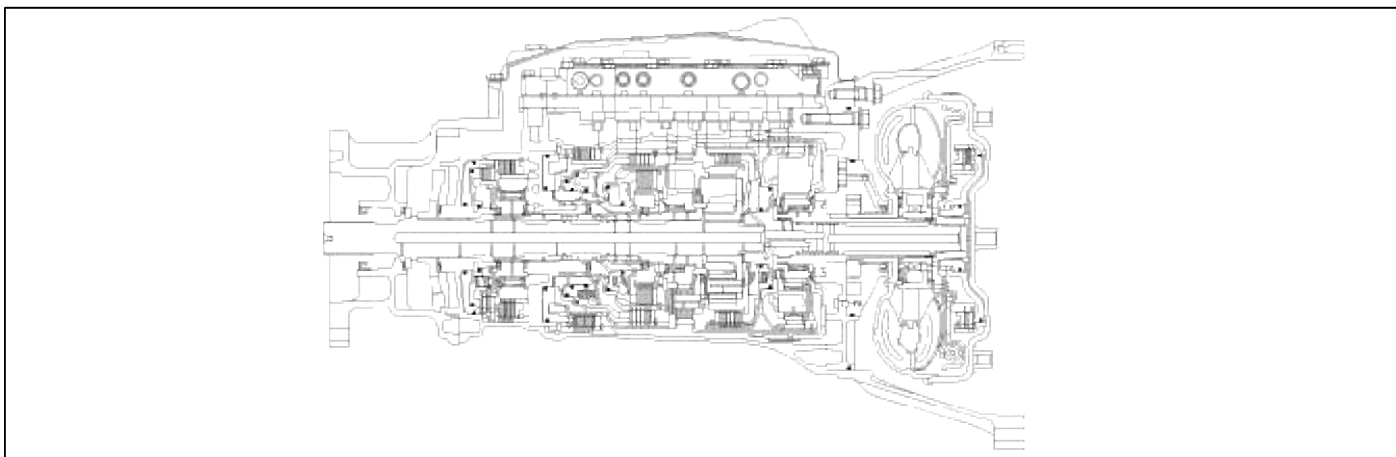
Go to the applicable troubleshooting procedure.

**NO** ☐

System performing to specification at this time.

### **Automatic Transaxle System > Troubleshooting > P0734**

#### **COMPONENT LOCATION**



#### **GENERAL DESCRIPTION**

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 4th gear ratio, while the transaxle is engaged in the 4th gear. For example, if the output speed is 1,000 rpm and the 4th gear ratio is 1.000, then the input speed is 1000 rpm.

#### **DTC DESCRIPTION**

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 4th gear ratio, while the transaxle is engaged in 4th gear.

#### **DTC DETECTING CONDITION**



Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• 4th gear incorrect ratio</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty input speed sensor</li> <li>• Faulty output speed sensor</li> <li>• Faulty internal transmission</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Engine speed &gt;600rpm</li> <li>• 150rpm &gt;Output speed &lt; 6000rpm</li> <li>• Lever Position = "D"</li> <li>• Input speed &gt; 600rpm</li> <li>• A/T oil temp output <math>\geq -10^{\circ}\text{C}</math></li> <li>• Throttle opening &gt;15%</li> <li>• The time after the last shift was finish &gt;1sec</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Input speed - output speed <math>\times</math> 4th gear ratio <math>\geq 200\text{rpm}</math></li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• More than 1sec</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• 4th gear Limp-Home mode</li> </ul>	

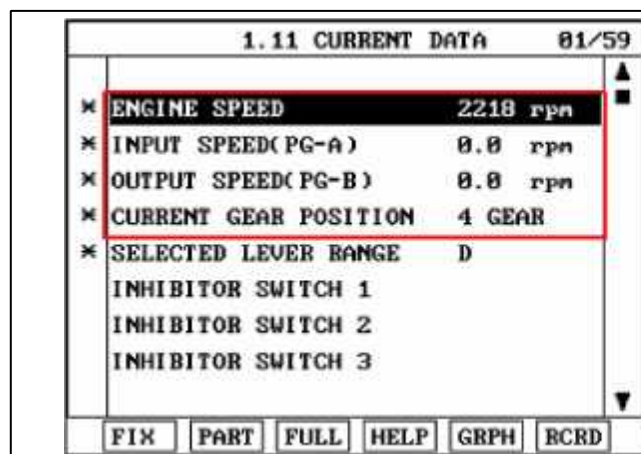
### MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" with gear position "4"

---

Specification :  $2300 \pm 200$  engine rpm

---



### OPERATING ELEMENT OF EACH SHIFTING RANGE

Shifting Position	Input clutch	High&Low Reverse Clutch	Direct clutch	Reverse Brake	Front Brake	Low Coast Brake	Forward Brake	1st OwnWayClutch	Forward OwnWayClutch	3rd OwnWayClutch
P		▲			▲					
R		●		●	●			●		●
N		▲			▲	★				
D	1st gear	★			▲		●	●	●	●
	2nd gear		●		▲		●		●	●
	3rd gear	●	●		●		▲	◆		●
	4th gear	●	●				▲	◆		
	5th gear	●	●		●		▲	◆		◆

● : WORKING.

◆ : PARTICIPATE IN DELIVERY TORQUE WHEN COAST DRIVING.

▲ : SUPPLYING OIL PRESSURE TO ELEMENT, BUT NOT EFFECT ON OUTPUT.

★ : TEMPORARY WORKING.

### Stall test procedure in D4 and reason

#### Procedure

A. Warm up the engine

B. After positioning the select lever in "D" or "ON" of the HOLD SW ( Operate UP SHIFT in case of "SPORTS MODE"),depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum.

\* The slippage of 4th gear operating parts can be detected by stall test in D4

#### Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in the torque converter.

B. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock

C. If 4th gear operating parts have faults, input speed revolution will be out.

D. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specification?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Go to "Component inspection" procedure.

#### CAUTION

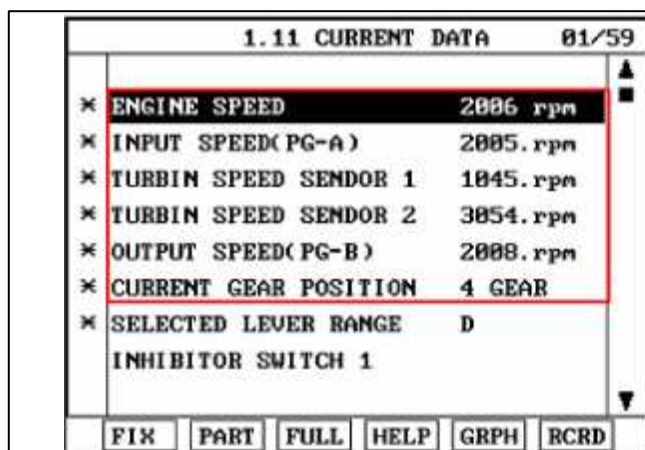
- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
- Check the A/T fluid level and temperature and the engine coolant temperature.
  - Fluid level : At the hot mark on the oil level gauge.
  - Fluid temperature : 176 °F~ 212 °F (80~100 °C).
  - Engine coolant temperature : 176 °F~ 212 °F (80~100 °C).
- Chock both rear wheels(left and right).
- Pull the parking brake lever on with the brake pedal fully depressed.
- The throttle should not be left fully open for more than eight seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent tests.

### SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.

4. Accelerate the Engine speed until about 2000 rpm in the 4th gear.

Specification :  $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times 4\text{th GEAR RATIO}) \leq 200 \text{ RPM}$



5. Does "INPUT&OUTPUT SPEED SENSOR" within specifications?

**YES**

Go to "Component Inspection" procedure.

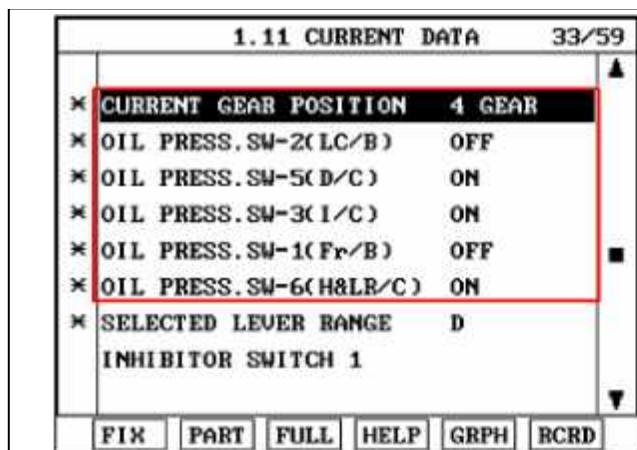
**NO**

Check condition of Input & Output Speed Sensor and sensor wiring. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "OIL PRESSURE. S/W 1,2,3,5,6" parameter on the scantool.
4. Move select lever to "D" range and operate vehicle within 4th gear condition.

Shift position		Oil Pressure Switch				
		I/C(SW3)	H&LR/C(SW6)	H&LR/C(SW6)	FR/B(SW1)	LC/B(SW2)
P		X	O	X	O	X
R		X	O	X	O	X
N		X	O	X	O	X
D	1st gear	X	X	X	O	X
	2nd gear	X	X	O	O	X
	3rd gear	X	O	O	O	X
	4th gear	O	O	O	X	X
	5th gear	O	O	X	O	X



5. Is oil pressure value within specifications?

**YES**

Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification of Vehicle Repair" procedure.

**NO**

Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present ?

**YES**

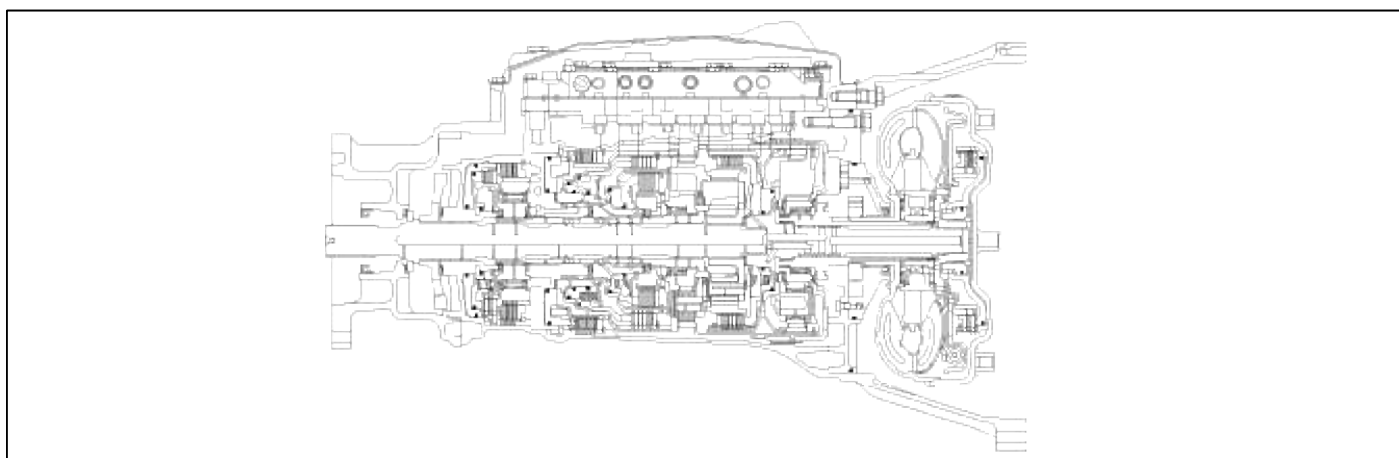
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > P0735

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 5th

gear ratio, while the transaxle is engaged in the 5th gear. For example, if the output speed is 1,000 rpm and the 5th gear ratio is 0.834, then the input speed is 834 rpm.

### DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 5th gear ratio, while the transaxle is engaged in 5th gear.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	<ul style="list-style-type: none"> <li>• 5th gear incorrect ratio</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty input speed sensor</li> <li>• Faulty output speed sensor</li> <li>• Faulty internal transmission</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Engine speed &gt;600rpm</li> <li>• 150rpm &gt; Output speed &lt; 6000rpm</li> <li>• Lever Position = "D"</li> <li>• Input speed &gt; 600rpm</li> <li>• A/T oil temp output <math>\geq -10^{\circ}\text{C}</math></li> <li>• Throttle opening &gt;15%</li> <li>• The time after the last shift was finish &gt;1sec</li> </ul>	
<b>Threshold value</b>	<ul style="list-style-type: none"> <li>• Input speed - output speed <math>\times</math> 5th gear ratio <math>\geq 200\text{rpm}</math></li> </ul>	
<b>Diagnostic Time</b>	<ul style="list-style-type: none"> <li>• More than 1sec</li> </ul>	
<b>Fail Safe</b>	<ul style="list-style-type: none"> <li>• 4th gear Limp-Home mode</li> </ul>	

### SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 5th gear.

---

Specification :  $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times 5\text{th GEAR RATIO}) \leq 200 \text{ RPM}$

---

1.11 CURRENT DATA 01/59	
× ENGINE SPEED	1972 rpm
× INPUT SPEED(PG-A)	1972.rpm
× TURBIN SPEED SENDOR 1	0.0 rpm
× TURBIN SPEED SENDOR 2	1973.rpm
× OUTPUT SPEED(PG-B)	2370.rpm
× CURRENT GEAR POSITION	5 GEAR
× SELECTED LEVER RANGE	D
INHIBITOR SWITCH 1	
<div> <div>FIX</div> <div>PART</div> <div>FULL</div> <div>HELP</div> <div>GRPH</div> <div>BCRD</div> </div>	

5. Does "INPUT&OUTPUT SPEED SENSOR" within specifications?

**YES**

Go to "Component Inspection" procedure.

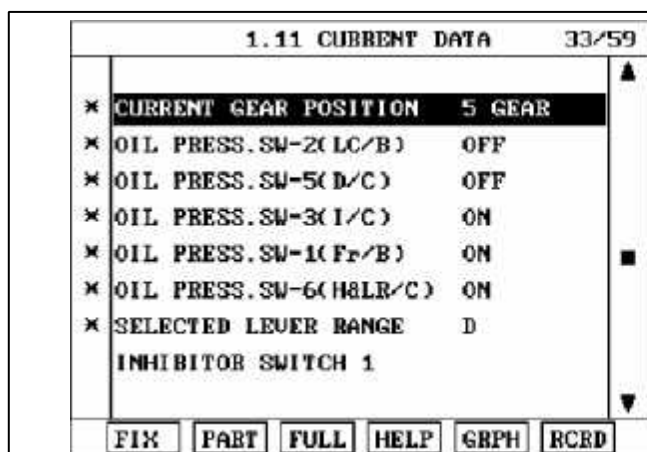
**NO**

Check condition of Input & Output Speed Sensor and sensor wiring. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "OIL PRESSURE. S/W 1,2,3,5,6" parameter on the scantool.
4. Move select lever to "D" range and operate vehicle within 5th gear condition.

Shift position		Oil Pressure Switch				
		I/C(SW3)	H&LR/C(SW6)	H&LR/C(SW6)	FR/B(SW1)	LC/B(SW2)
P		X	O	X	O	X
R		X	O	X	O	X
N		X	O	X	O	X
D	1st gear	X	X	X	O	X
	2nd gear	X	X	O	O	X
	3rd gear	X	O	O	O	X
	4th gear	O	O	O	X	X
	5th gear	O	O	X	O	X



5. Is oil pressure value within specifications?

**YES**

Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification of Vehicle Repair" procedure.

**NO**

Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present ?

**YES**

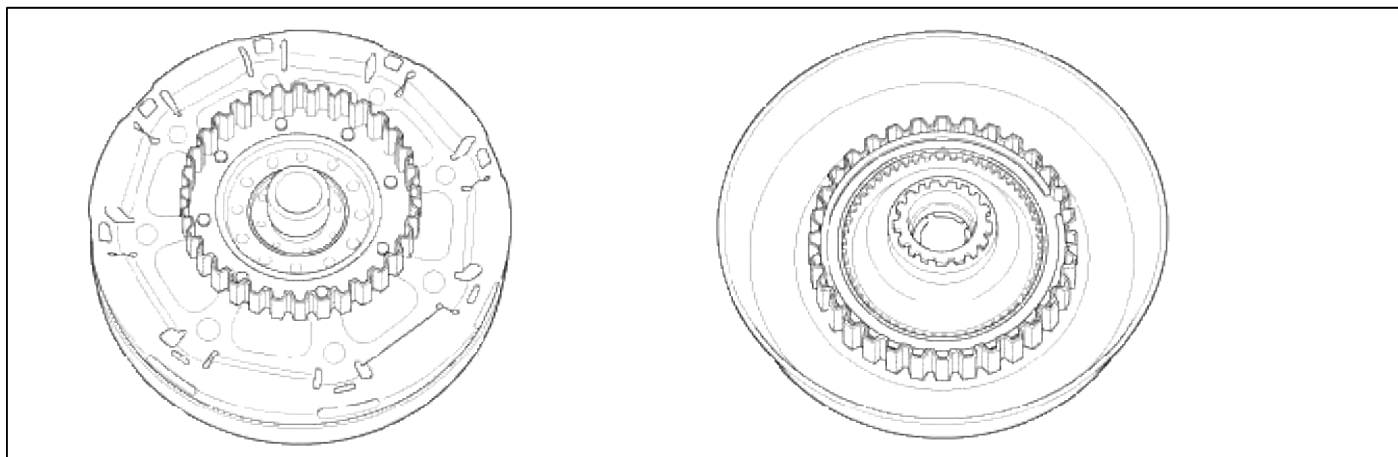
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > P0741

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The PCM/TCM controls the locking and unlocking of the Torque Converter Clutch ( or Damper Clutch ), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The TCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve( DCCSV ) and hydraulic pressure is applied to DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control current is from 0.05A(unlocked) to 0.75A(locked).

### DTC DESCRIPTION

The PCM/TCM increases the duty ratio to engage the Damper Clutch by monitoring slip rpms (difference vlaue between engine speed and turbine speed).

To decrease the slip of the Damper Clutch, the TCM increases the duty ratio by applying more hyraulic pressure. When slip rpm does not drop within specifications with 100% duty ratio, the PCM/TCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Stuck "OFF"	<b>TORQUE CONVERTER(DAMPER) CLUTCH : TCC</b> <ul style="list-style-type: none"> <li>• Faulty TCC or oil pressure system</li> <li>• Faulty TCC solenoid valve</li> <li>• Faulty body control valve</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• Duty of "Damper clutch solenoid valve" = 100%</li> <li>• Input speed &gt; 0rpm</li> </ul>	
<b>Threshold value</b>	• Calculated slip (engine speed-input speed)>100rpm	
<b>Diagnostic Time</b>	• More than 5sec	
<b>Fail Safe</b>	• Damper clutch "OFF"	

#### Monitor Scantool Data

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Select "D RANGE" and drive vehicle 5 gear.
4. Monitor the "TORQUE CONVERTER(DAMPER) CLUTCH" parameter on the scantool .

---

Specification : Calculated slip (engine speed-input speed) < 100rpm

---



1.11 CURRENT DATA 09/59	
* ENGINE SPEED	721 rpm
* INPUT SPEED(PG-A)	701.0rpm
* TCC SLIP RPM	8.0 rpm
* TCCSV(LU)	0.0 %
* TCCSV CURRENT(LU)	48.0 mA
* TCCSV PRESSURE(LU)	-43.5psi
* CURRENT GEAR POSITION	P N
* SELECTED LEVER RANGE	N

FIG.1)

1.11 CURRENT DATA 09/59	
* ENGINE SPEED	895 rpm
* INPUT SPEED(PG-A)	848.0rpm
* TCC SLIP RPM	53.0 rpm
* TCCSV(LU)	0.0 %
* TCCSV CURRENT(LU)	48.0 mA
* TCCSV PRESSURE(LU)	-43.5psi
* CURRENT GEAR POSITION	REVERSE
* SELECTED LEVER RANGE	R

FIG.2)

1.11 CURRENT DATA 09/59	
* ENGINE SPEED	1039 rpm
* INPUT SPEED(PG-A)	1021.0rpm
* TCC SLIP RPM	33.0 rpm
* TCCSV(LU)	0.0 %
* TCCSV CURRENT(LU)	48.0 mA
* TCCSV PRESSURE(LU)	-43.5psi
* CURRENT GEAR POSITION	1 GEAR
* SELECTED LEVER RANGE	D

FIG.3)

1.11 CURRENT DATA 09/59	
* ENGINE SPEED	1668 rpm
* INPUT SPEED(PG-A)	1642.0rpm
* TCC SLIP RPM	16.0 rpm
* TCCSV(LU)	0.0 %
* TCCSV CURRENT(LU)	48.0 mA
* TCCSV PRESSURE(LU)	-43.5psi
* CURRENT GEAR POSITION	2 GEAR
* SELECTED LEVER RANGE	D

FIG.4)

1.11 CURRENT DATA 09/59	
* ENGINE SPEED	2335 rpm
* INPUT SPEED(PG-A)	2325.0rpm
* TCC SLIP RPM	20.0 rpm
* TCCSV(LU)	0.0 %
* TCCSV CURRENT(LU)	48.0 mA
* TCCSV PRESSURE(LU)	-43.5psi
* CURRENT GEAR POSITION	3 GEAR
* SELECTED LEVER RANGE	D

FIG.5)

1.11 CURRENT DATA 09/59	
* ENGINE SPEED	2293 rpm
* INPUT SPEED(PG-A)	2304.0rpm
* TCC SLIP RPM	0.0 rpm
* TCCSV(LU)	38.4 %
* TCCSV CURRENT(LU)	308.0mA
* TCCSV PRESSURE(LU)	5.8 psi
* CURRENT GEAR POSITION	4 GEAR
* SELECTED LEVER RANGE	D

FIG.6)

1.11 CURRENT DATA 09/59	
* ENGINE SPEED	2352 rpm
* INPUT SPEED(PG-A)	2353.0rpm
* TCC SLIP RPM	0.0 rpm
* TCCSV(LU)	42.0 %
* TCCSV CURRENT(LU)	400.0mA
* TCCSV PRESSURE(LU)	10.1 psi
* CURRENT GEAR POSITION	5 GEAR
* SELECTED LEVER RANGE	D

FIG.7)

FIG.1) "P,N" range

FIG.2) "R" range

FIG.3) "D" range 1st gear

FIG.4) "D" range 2nd gear

FIG.5) "D" range 3rd gear

FIG.6) "D" range 4th gear

FIG.7) "D" range 5th gear

5. Is "TCC SLIP(DAMPER CLUTCH SL.RPM)" within specifications?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

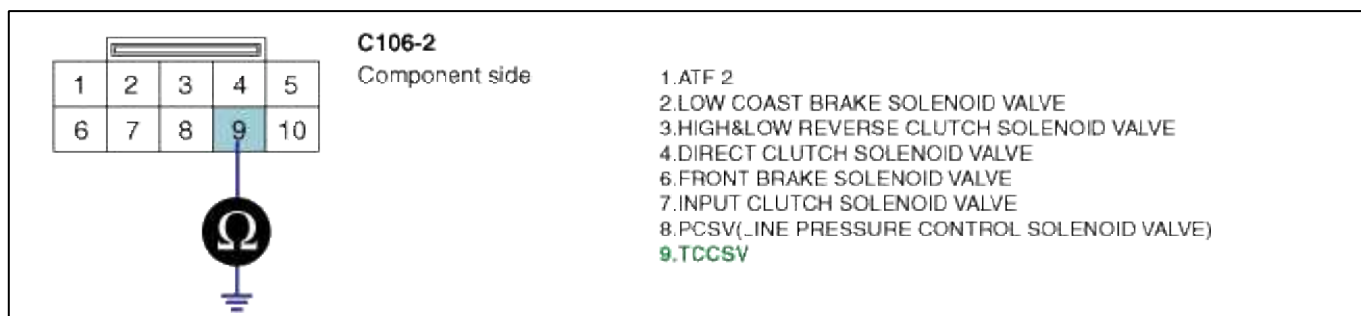
**NO**

Go to "Component Inspection" procedure.

## COMPONENT INSPECTION

1. Disconnect "C106-2" connector.
2. Ignition "OFF".
3. Measure resistance between terminal "9" of the C106-2 harness connector and chassis ground.

Specification : approx. 3~9Ω



4. Is resistance within specifications?

**YES**

Repair TORQUE CONVERTER CLUTCH(REPLACE Torque Converter ) as necessary and Go to "Verification of Vehicle Repair" procedure.

**NO**

Replace A/T assembly (possible to BODY CONTROL VALVE faulty) as necessary and Go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

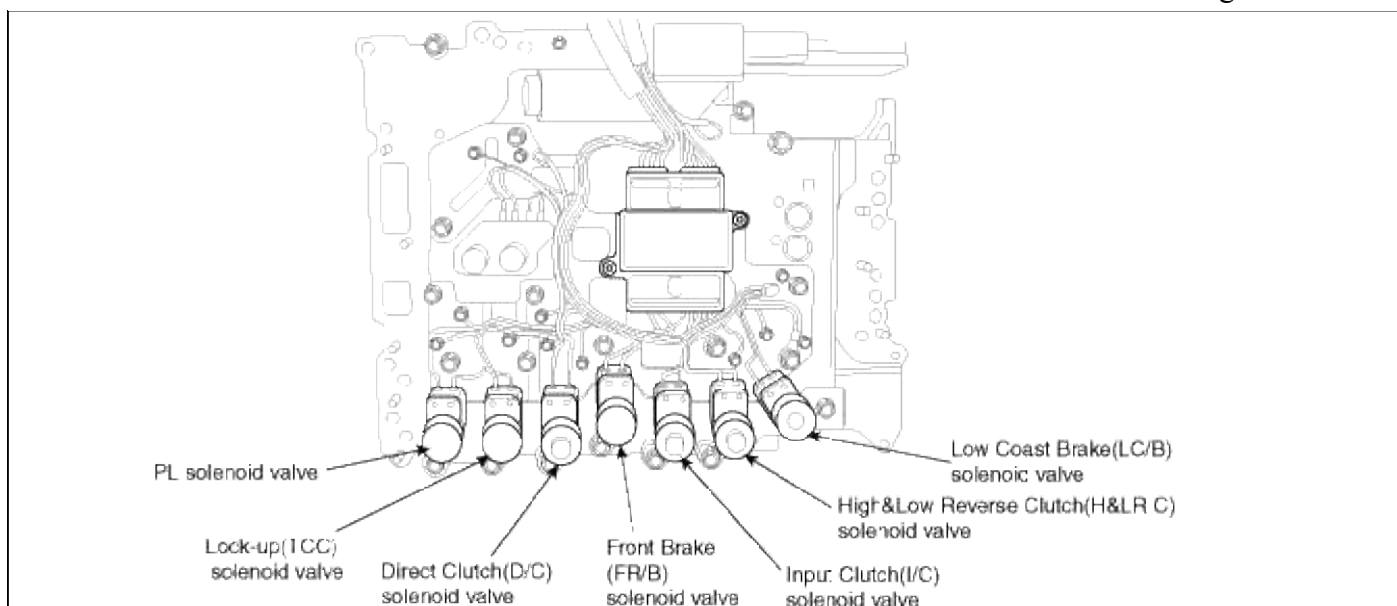
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

#### Automatic Transaxle System > Troubleshooting > P0743

#### COMPONENT LOCATION



## GENERAL DESCRIPTION

The PCM/TCM controls the locking and unlocking of the Torque Converter Clutch ( or Damper Clutch ), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The TCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve(DCCSV) and hydraulic pressure is applied to DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control current is from 0.05A(unlocked) to 0.75A(locked).

## DTC DESCRIPTION

The TCM checks the Damper Clutch Control Signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the TCM judges that the DCCSV circuit is malfunctioning and sets this code.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check voltage range	<b>TORQUE CONVERTER(DAMPER) CLUTCH : TCC</b> <ul style="list-style-type: none"> <li>• Open or short in circuit</li> <li>• Faulty TCC SOLENOID VALVE</li> <li>• Faulty PCM/TCM</li> </ul>
<b>Enable Conditions</b>	• 10V < Actuator power supply voltage < 16V	
<b>Threshold value</b>	• Hardware "IC" check	
<b>Diagnostic Time</b>	• More than 0.2sec	
<b>Fail Safe</b>	• Lock-up control is prohibited(L/U off)	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "TCC SOL. VALVE" parameter on the scantool.
4. Select "D RANGE" and Operate the vehicle 5 gear.

## 5. Check "TCC SOL. VALVE" parameter value changes while driving.

1.3 CURRENT DATA			87/76
✖ TURBIN SPEED SENSOR	0	rpm	
✖ ENGINE SPEED	736	rpm	
✖ DAMPER CLUTCH SL.RPM	254	rpm	
✖ LU SOL. OUTPUT	0.01	A	
✖ LU SOL. MONITOR	0.00	A	
✖ CURRENT GEAR POS.	1	GEAR	
✖ SHIFT RANGE INDICATOR	D		
SELECTED LEVER RANGE			
FIX PART FULL HELP GRPH BCRD			

FIG.1)

1.3 CURRENT DATA			87/76
✖ TURBIN SPEED SENSOR	2720	rpm	
✖ ENGINE SPEED	2720	rpm	
✖ DAMPER CLUTCH SL.RPM	0	rpm	
✖ LU SOL. OUTPUT	0.45	A	
✖ LU SOL. MONITOR	0.57	A	
✖ CURRENT GEAR POS.	4	GEAR	
✖ SHIFT RANGE INDICATOR	-		
SELECTED LEVER RANGE			
FIX PART FULL HELP GRPH BCRD			

FIG.2)

FIG.1) Not engagement status of TCC

FIG.2) Engagement status of TCC

## 6. Does "TCC SOLENOID DUTY " follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of vehicle repair" procedure.

**NO**

Go to "Terminal&connector inspection" procedure.

## TERMINAL &amp; CONNECTOR INSPECTION

- Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES**

Repair as necessary and then go to "Verification of vehicle repair" procedure.

**NO**

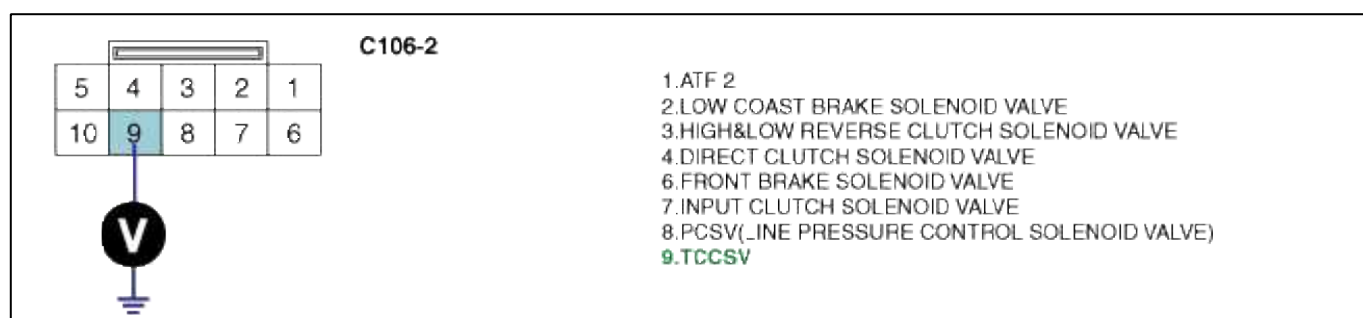
Go to "Signal circuit Inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

- Disconnect "C106-2" connector.
- IGNITION "ON", ENGINE "OFF".

3. Measure voltage between terminal "9" of the C106-2 harness connector and chassis ground.

Specification : approx. 5V



4. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

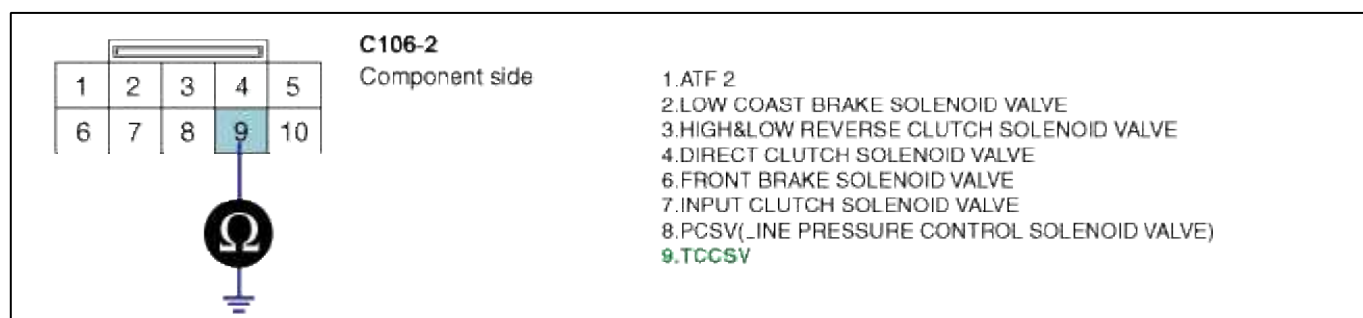
**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Disconnect "C106-2" connector.
2. Ignition "OFF".
3. Measure resistance between terminal "9" of the C106-2 harness connector and chassis ground.

Specification : approx. 3~9Ω



4. Is resistance within specifications?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

5. Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Replace "TCC SOLENOID VALVE" as necessary and Go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.

3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present?

**YES**

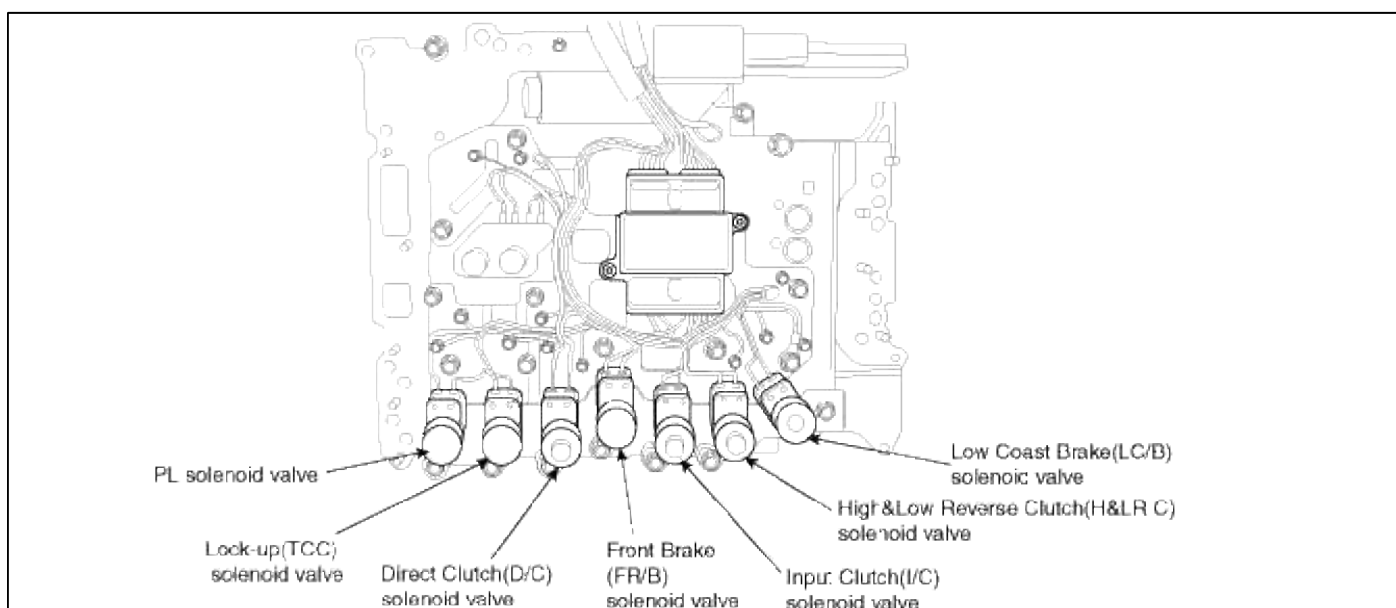
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > P0748

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The line pressure solenoid valve regulates the oil pump discharge pressure to suit the driving condition in response to a signal sent from the TCM. The line pressure duty cycle valve is not consistent when the closed throttle position signal is "ON".

### DTC DESCRIPTION

To confirm the line pressure duty cycle at low pressure, the accelerator (throttle) should be open until the closed throttle position signal is "OFF".

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check voltage range	PRESSURE CONTROL SOLENOID VALVE(LINE PRESSURE : PCSV(PL. SOL)) • Open or short in circuit • Faulty PCSV • Faulty TCM
<b>Enable Conditions</b>	• $10V < \text{Actuator power supply voltage} < 16V$	
<b>Threshold value</b>	• Hardware "IC" check	
<b>Diagnostic Time</b>	• More than 0.2sec	
<b>Fail Safe</b>	• Lock-up control is prohibited(L/U off)	

### MONITOR SCANTOOL DATA



1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "PCSV" parameter on the scantool.
4. Select "D RANGE" and Operate the vehicle.
5. Check "PCSV" parameter value changes while driving.

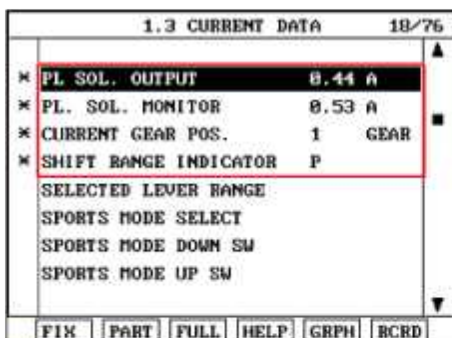


FIG.1)

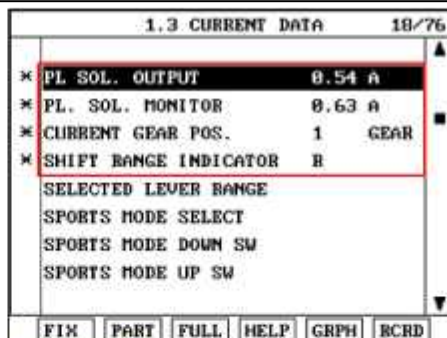


FIG.2)

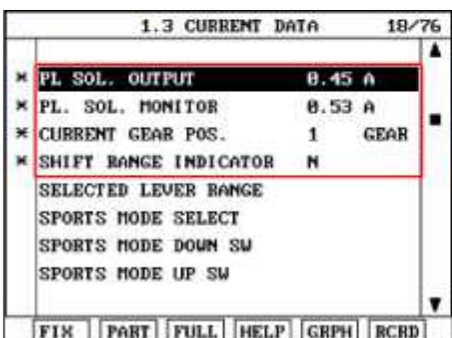


FIG.3)

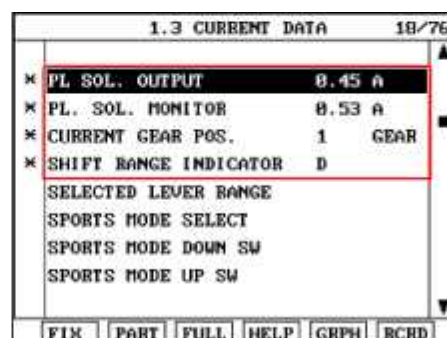


FIG.4)

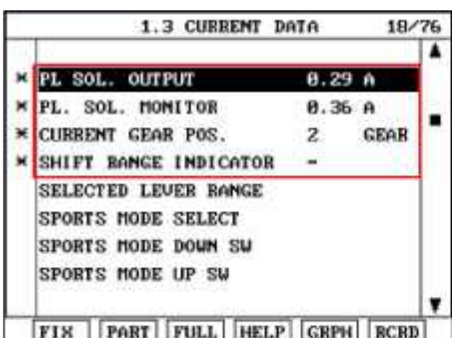


FIG.5)

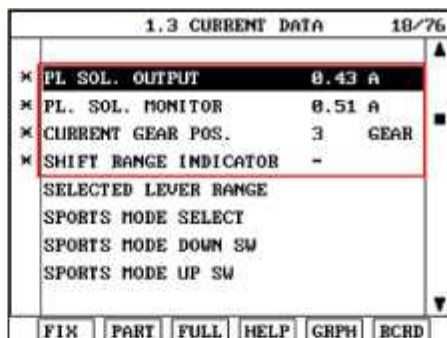


FIG.6)

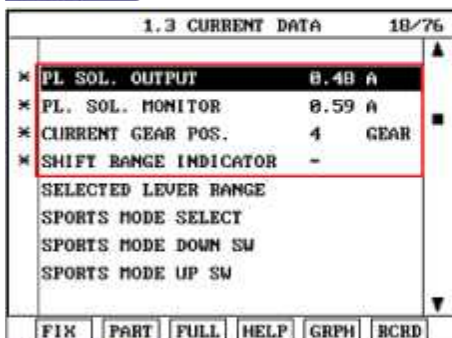


FIG.7)

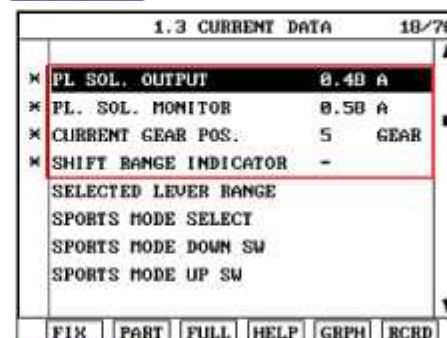


FIG.8)

FIG.1) "P" Range

FIG.2) "R" Shifting

FIG.3) "N" Range

FIG.4) "D" Range 1st gear

FIG.5) "D" Range 2nd gear

FIG.6) "D" Range 3rd gear

FIG.7) "D" Range 4th gear

FIG.8) "D" Range 5th gear

6. Does "PCSV DUTY " follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal&connector inspection " procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification of vehicle repair" procedure.

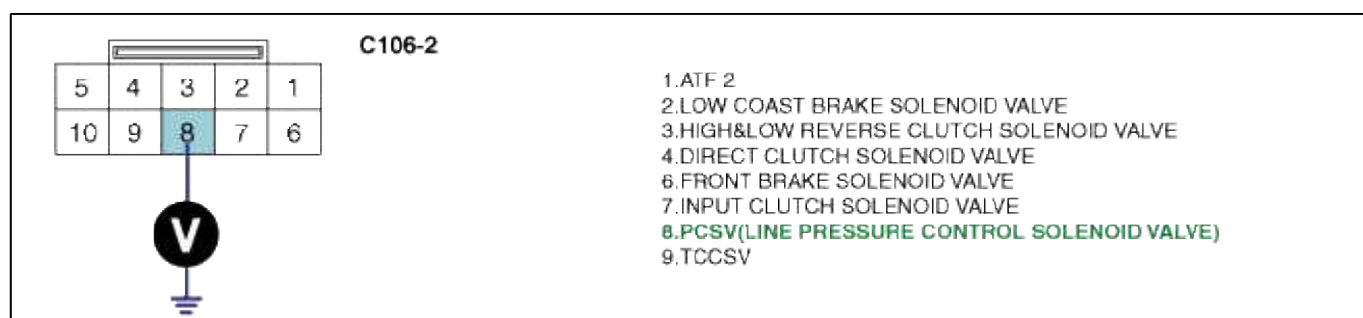
**NO**

Go to "Signal circuit Inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Disconnect "C106-2" connector.
2. IGNITION "ON", ENGINE "OFF"
3. Measure voltage between terminal "8" of the C106-2 harness connector and chassis ground.

Specification : approx. 5V



4. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

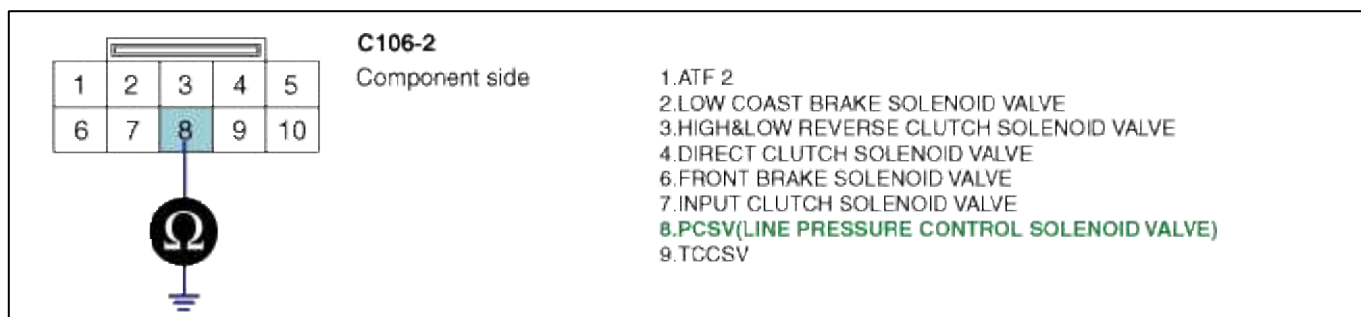
## COMPONENT INSPECTION

1. Disconnect "C106-2" connector.
2. Ignition "OFF".



3. Measure resistance between terminal "8" of the C106-2 harness connector and chassis ground.

Specification : approx. 3~9Ω



4. Is resistance within specifications?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

5. Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
If signal circuit in harness is OK, Replace "PRESSURE CONTROL SOLENOID VALVE" as necessary and Go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

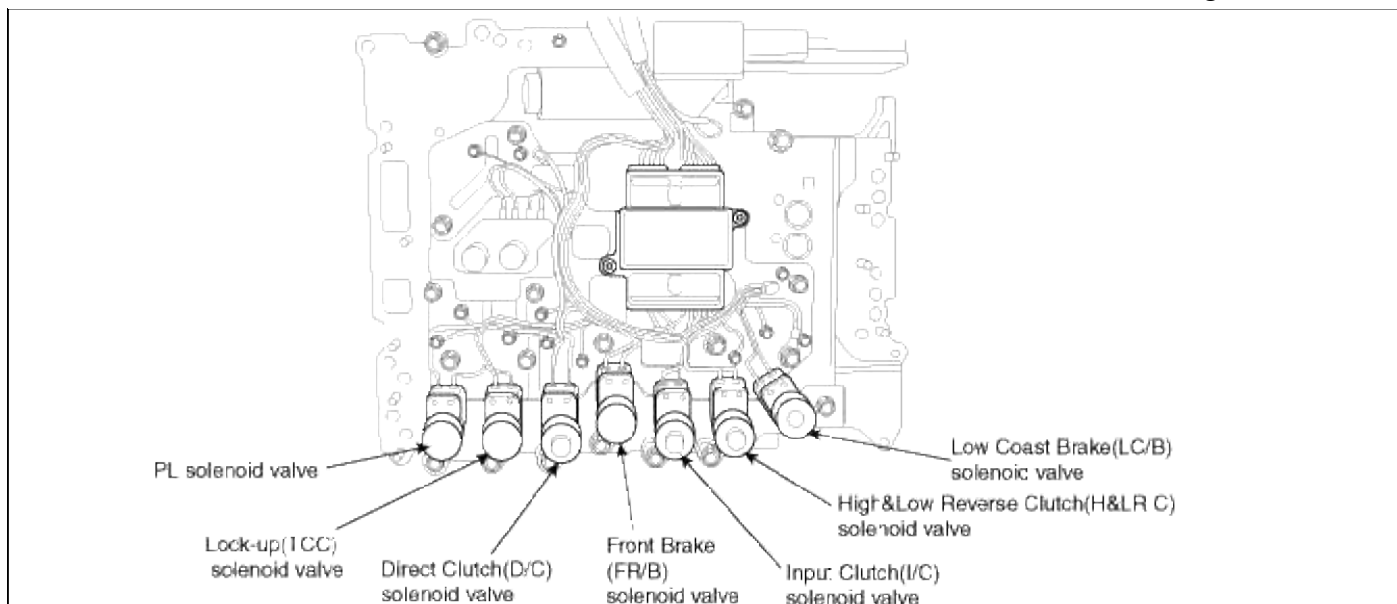
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

#### Automatic Transaxle System > Troubleshooting > P0753

#### COMPONENT LOCATION



## GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. Input clutch solenoid valve is controlled by the TCM in response to signals sent from the inhibitor switch, vehicle speed sensor and accelerator pedal position sensor (throttle position sensor). Gears will then be shifted to the optimum position.

## DTC DESCRIPTION

This is not only caused by electrical malfunction (circuits open or shorted) but also by mechanical malfunction such as control valve sticking, improper solenoid valve operation.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check voltage range	<b>INPUT CLUTCH SOLENOID VALVE : I/C SOLENOID VALVE</b> <ul style="list-style-type: none"> <li>• Open or short in circuit</li> <li>• Faulty I/C SOLENOID VALVE</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	• 10V < Actuator power supply voltage < 16V	
<b>Threshold value</b>	• Hardware "IC" check	
<b>Diagnostic Time</b>	• More than 0.2sec	
<b>Fail Safe</b>	• Lock-up control is prohibited(L/U off)	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "I/C SOLENOID" parameter on the scantool.
4. Select "D RANGE" and Operate the vehicle.

## 5. Check "I/C SOLENOID" parameter value changes while driving.

1.3 CURRENT DATA		28/76
* I/C SOL. OUTPUT	0.69 A	
* I/C SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	1 GEAR	
* SHIFT RANGE INDICATOR	P	
* OIL PRESS SW3(I/C)	OFF	
SPORTS MODE UP SW		
SPORTS MODE GEAR POS.		
INHIBITOR SW. MONITOR		
FIX	PART	FULL
HELP	GRPH	BCRD

FIG.1)

1.3 CURRENT DATA		28/76
* I/C SOL. OUTPUT	0.78 A	
* I/C SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	1 GEAR	
* SHIFT RANGE INDICATOR	R	
* OIL PRESS SW3(I/C)	OFF	
SPORTS MODE UP SW		
SPORTS MODE GEAR POS.		
INHIBITOR SW. MONITOR		
FIX	PART	FULL
HELP	GRPH	BCRD

FIG.2)

1.3 CURRENT DATA		28/76
* I/C SOL. OUTPUT	0.78 A	
* I/C SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	1 GEAR	
* SHIFT RANGE INDICATOR	N	
* OIL PRESS SW3(1/C)	OFF	
SPORTS MODE UP SW		
SPORTS MODE GEAR POS.		
INHIBITOR SW. MONITOR		
FIX	PART	FULL
HELP	GRPH	BCRD

FIG.3)

1.3 CURRENT DATA		28/76
* I/C SOL. OUTPUT	0.78 A	
* I/C SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	1 GEAR	
* SHIFT RANGE INDICATOR	D	
* OIL PRESS SW3(I/C)	OFF	
SPORTS MODE UP SW		
SPORTS MODE GEAR POS.		
INHIBITOR SW. MONITOR		
FIX	PART	FULL
HELP	GRPH	RCRD

FIG.4)

1.3 CURRENT DATA		28/76
* I/C SOL. OUTPUT	0.69 A	
* I/C SOL. MONITOR	0.79 A	
* CURRENT GEAR POS.	2 GEAR	
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW3(I/C)	OFF	
SPORTS MODE UP SW		
SPORTS MODE GEAR POS.		
INHIBITOR SW. MONITOR		
FIX	PART	FULL
HELP	GRPH	BCRD

FIG.5)

1.3 CURRENT DATA		28/76
* I/C SOL. OUTPUT	0.68 A	
* I/C SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	3 GEAR	
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW3(I/C)	OFF	
SPORTS MODE UP SW		
SPORTS MODE GEAR POS.		
INHIBITOR SW. MONITOR		
FIX	PART	FULL
HELP	GRPH	BCRD

FIG.6)

1.3 CURRENT DATA		28/76
* I/C SOL. OUTPUT	0.81 A	
* I/C SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	4 GEAR	
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW3(I/C)	ON	
SPORTS MODE UP SW		
SPORTS MODE GEAR POS.		
INHIBITOR SW. MONITOR		
FIX	PART	FULL
HELP	GRPH	BCRD

FIG.7)

1.3 CURRENT DATA		28/76
×	I/C SOL. OUTPUT	0.81 A
×	I/C SOL. MONITOR	0.88 A
×	CURRENT GEAR POS.	5 GEAR
×	SHIFT RANGE INDICATOR	-
×	OIL PRESS SW3(I/C)	ON
SPORTS MODE UP SW		
SPORTS MODE GEAR POS.		
INHIBITOR SW. MONITOR		
FIX	PART	FULL
HELP	GRPH	RCRD

FIG.8)

FIG.1) "P" Range

FIG.2) "R" Shifting

FIG.3) "N" Range

FIG.4) "D" Range 1st gear

FIG.5) "D" Range 2nd gear

FIG.6) "D" Range 3rd gear

FIG.7) "D" Range 4th gear

FIG.8) "D" Range 5th gear

6. Does "I/C SOLENOID " follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal&connector inspection " procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification of vehicle repair" procedure.

**NO**

Go to "Signal circuit Inspection" procedure.

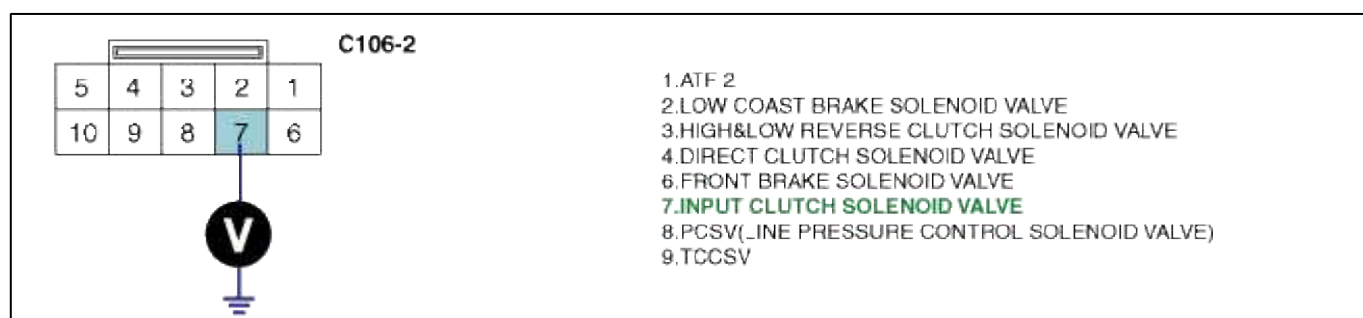
## SIGNAL CIRCUIT INSPECTION

1. Disconnect "C106-2" connector.
2. IGNITION "ON", ENGINE "OFF"
3. Measure voltage between terminal "7" of the C106-2 harness connector and chassis ground.

---

Specification : Output voltage repeated between 4V and 12V

---



4. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

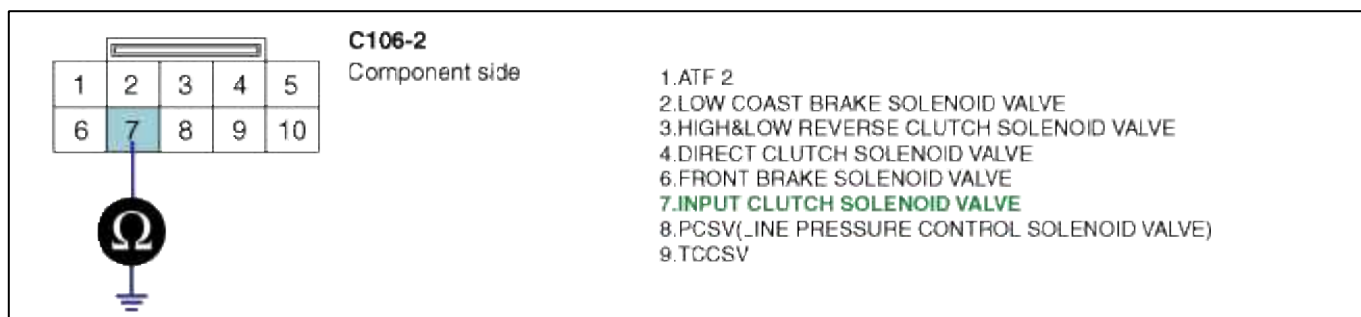
Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Disconnect "C106-2" connector.
2. Ignition "OFF".

3. Measure resistance between terminal "7" of the C106-2 harness connector and chassis ground.

Specification : approx. 3~9Ω



4. Is resistance within specifications?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

5. Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
If signal circuit in harness is OK, Replace "I/C SOLENOID VALVE" as necessary and Go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

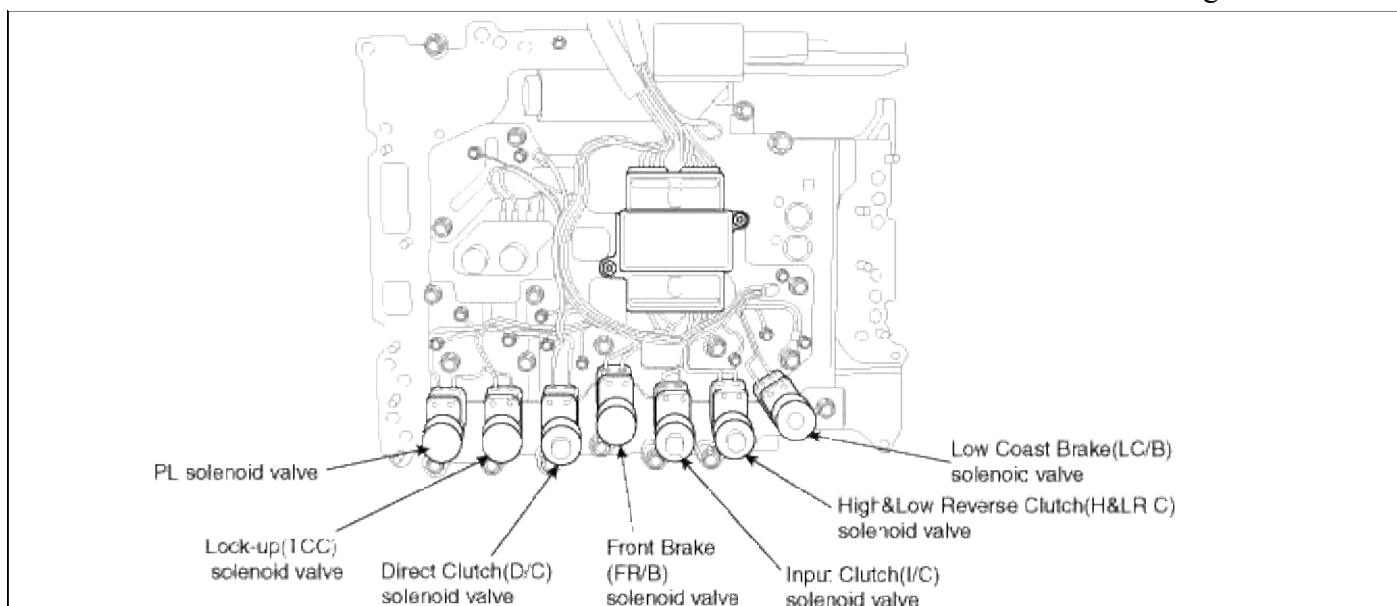
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

#### Automatic Transaxle System > Troubleshooting > P0758

#### COMPONENT LOCATION



## GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. Front brake solenoid valve is controlled by the TCM in response to signals sent from the inhibitor switch, vehicle speed sensor and accelerator pedal position sensor (throttle position sensor). Gear will then be shifted to the optimum position.

## DTC DESCRIPTION

This is not only caused by electrical malfunction (circuit open or shorted) but also by mechanical malfunction such as control valve sticking, improper solenoid valve operation.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check voltage range	<b>FRONT BRAKE SOLENOID VALVE : Fr/B SOLENOID VALVE</b> • Open or short in circuit • Faulty Fr/B SOLENOID VALVE • Faulty TCM
<b>Enable Conditions</b>	• 10V < Actuator power supply voltage < 16V	
<b>Threshold value</b>	• Hardware "IC" check	
<b>Diagnostic Time</b>	• More than 0.2sec	
<b>Fail Safe</b>	• Lock-up control is prohibited(L/U off)	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "Fr/B SOLENOID" parameter on the scantool.
4. Select "R,D RANGE" and Operate the vehicle.



## 5. Check "Fr/B SOLENOID" parameter value changes while driving.

1.3 CURRENT DATA		22/76
* FR/B SOL. OUTPUT	0.70 A	
* FR/B SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	1	GEAR
* SHIFT RANGE INDICATOR	P	
* OIL PRESS SW1(FR/B)	ON	
BRAKE SWITCH		
REVERSE LAMP		
STARTER RELAY MONITOR		
FIX PART FULL HELP GRPH RCRD		

FIG.1)

1.3 CURRENT DATA		22/76
* FR/B SOL. OUTPUT	0.71 A	
* FR/B SOL. MONITOR	0.79 A	
* CURRENT GEAR POS.	1	GEAR
* SHIFT RANGE INDICATOR	R	
* OIL PRESS SW1(FR/B)	ON	
BRAKE SWITCH		
REVERSE LAMP		
STARTER RELAY MONITOR		
FIX PART FULL HELP GRPH RCRD		

FIG.2)

1.3 CURRENT DATA		22/76
* FR/B SOL. OUTPUT	0.71 A	
* FR/B SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	1	GEAR
* SHIFT RANGE INDICATOR	N	
* OIL PRESS SW1(FR/B)	ON	
BRAKE SWITCH		
REVERSE LAMP		
STARTER RELAY MONITOR		
FIX PART FULL HELP GRPH RCRD		

FIG.3)

1.3 CURRENT DATA		22/76
* FR/B SOL. OUTPUT	0.71 A	
* FR/B SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	1	GEAR
* SHIFT RANGE INDICATOR	D	
* OIL PRESS SW1(FR/B)	ON	
BRAKE SWITCH		
REVERSE LAMP		
STARTER RELAY MONITOR		
FIX PART FULL HELP GRPH RCRD		

FIG.4)

1.3 CURRENT DATA		22/76
* FR/B SOL. OUTPUT	0.70 A	
* FR/B SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	2	GEAR
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW1(FR/B)	ON	
BRAKE SWITCH		
REVERSE LAMP		
STARTER RELAY MONITOR		
FIX PART FULL HELP GRPH RCRD		

FIG.5)

1.3 CURRENT DATA		22/76
* FR/B SOL. OUTPUT	0.69 A	
* FR/B SOL. MONITOR	0.79 A	
* CURRENT GEAR POS.	3	GEAR
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW1(FR/B)	ON	
BRAKE SWITCH		
REVERSE LAMP		
STARTER RELAY MONITOR		
FIX PART FULL HELP GRPH RCRD		

FIG.6)

1.3 CURRENT DATA		22/76
* FR/B SOL. OUTPUT	0.81 A	
* FR/B SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	4	GEAR
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW1(FR/B)	OFF	
BRAKE SWITCH		
REVERSE LAMP		
STARTER RELAY MONITOR		
FIX PART FULL HELP GRPH RCRD		

FIG.7)

1.3 CURRENT DATA		22/76
* FR/B SOL. OUTPUT	0.68 A	
* FR/B SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	5	GEAR
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW1(FR/B)	ON	
BRAKE SWITCH		
REVERSE LAMP		
STARTER RELAY MONITOR		
FIX PART FULL HELP GRPH RCRD		

FIG.8)

FIG.1) "P" Range

FIG.2) "R" Shifting

FIG.3) "N" Range

FIG.4) "D" Range 1st gear

FIG.5) "D" Range 2nd gear

FIG.6) "D" Range 3rd gear

FIG.7) "D" Range 4th gear

FIG.8) "D" Range 5th gear

6. Does "Fr/B SOLENOID" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal&connector inspection " procedure.

#### TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification of vehicle repair" procedure.

**NO**

Go to "Signal circuit Inspection" procedure.

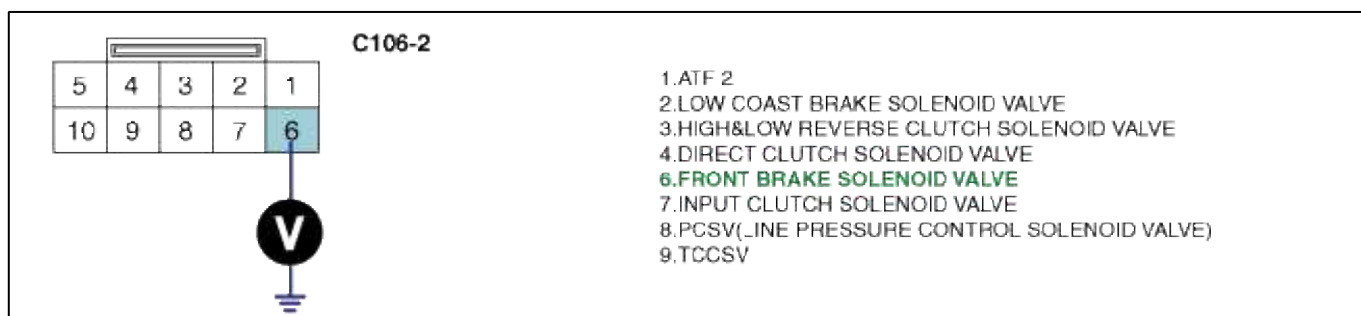
#### SIGNAL CIRCUIT INSPECTION

1. Disconnect "C106-2" connector.
2. IGNITION "ON", ENGINE "OFF"
3. Measure voltage between terminal "6" of the C106-2 harness connector and chassis ground.

---

Specification : approx. 5V

---



4. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

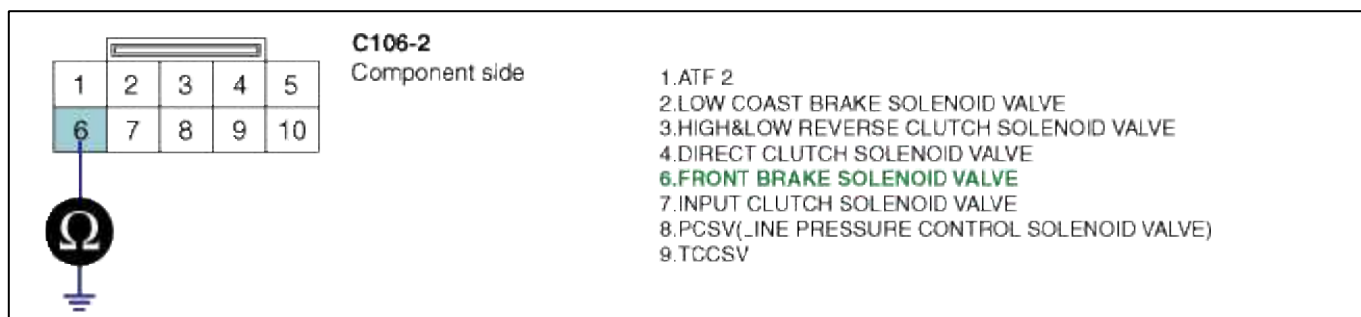
#### COMPONENT INSPECTION

1. Disconnect "C106-2" connector.
2. Ignition "OFF".



3. Measure resistance between terminal "6" of the C106-2 harness connector and chassis ground.

Specification : approx. 3~9Ω



4. Is resistance within specifications?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

5. Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Replace "Fr/B SOLENOID VALVE" as necessary and Go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

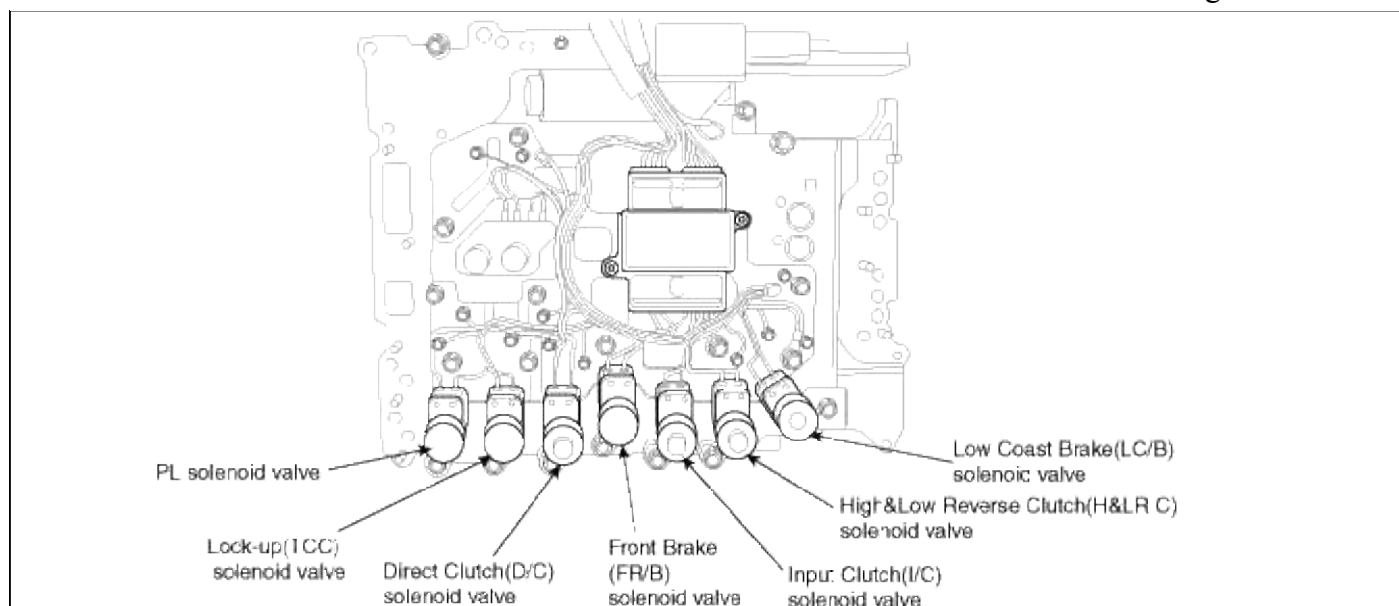
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

#### Automatic Transaxle System > Troubleshooting > P0763

#### COMPONENT LOCATION



## GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. Direct clutch solenoid valve is controlled by the TCM in response to signals sent from the inhibitor switch, vehicle speed sensor and accelerator pedal position sensor (throttle position sensor). Gears will then be shifted to the optimum position.

## DTC DESCRIPTION

This is not only caused by electrical malfunction (circuits open or shorted) but also by mechanical malfunction such as control valve sticking, improper solenoid valve operation.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check voltage range	<b>DIRECT CLUTCH SOLENOID VALVE : D/C SOLENOID VALVE</b> • Open or short in circuit • Faulty D/C SOLENOID VALVE • Faulty TCM
<b>Enable Conditions</b>	• 10V < Actuator power supply voltage < 16V	
<b>Threshold value</b>	• Hardware "IC" check	
<b>Diagnostic Time</b>	• More than 0.2sec	
<b>Fail Safe</b>	• Lock-up control is prohibited(L/U off)	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "D/C SOLENOID" parameter on the scantool.
4. Select "D RANGE" and Operate the vehicle.

## 5. Check "D/C SOLENOID" parameter value changes while driving.

1.3 CURRENT DATA		24/76
✖	D/C SOL. OUTPUT	0.72 A
✖	D/C SOL. MONITOR	0.79 A
✖	CURRENT GEAR POS.	1 GEAR
✖	SHIFT RANGE INDICATOR	P
✖	OIL PRESS SW5(D/C)	OFF
	OIL PRESS SW3(I/C)	
	OIL PRESS SW2(LC/B)	
	OIL PRESS SW1(FR/B)	
FIX		PART
FULL		HELP
GRPH		BCRD

FIG.1)

1.3 CURRENT DATA		24/76
✖	D/C SOL. OUTPUT	0.72 A
✖	D/C SOL. MONITOR	0.88 A
✖	CURRENT GEAR POS.	1 GEAR
✖	SHIFT RANGE INDICATOR	R
✖	OIL PRESS SW5(D/C)	OFF
	OIL PRESS SW3(I/C)	
	OIL PRESS SW2(LC/B)	
	OIL PRESS SW1(FR/B)	
FIX PART FULL HELP GRPH RCRD		

FIG.2)

1.3 CURRENT DATA		24/76
✖	D/C SOL. OUTPUT	0.72 A
✖	D/C SOL. MONITOR	0.79 A
✖	CURRENT GEAR POS.	1 GEAR
✖	SHIFT RANGE INDICATOR	N
✖	OIL PRESS SW5(D/C)	OFF
	OIL PRESS SW3(I/C)	
	OIL PRESS SW2(LC/B)	
	OIL PRESS SW1(FR/B)	
FIX		PART
FULL		HELP
GRPH		BCRD

FIG.3)

1.3 CURRENT DATA		24/76
×	D/C SOL. OUTPUT	0.72 A
×	D/C SOL. MONITOR	0.88 A
×	CURRENT GEAR POS.	1 GEAR
×	SHIFT RANGE INDICATOR	D
×	OIL PRESS SW5(D/C)	OFF
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
OIL PRESS SW1(FR/B)		
FIX	PART	FULL
HELP	GRPH	RCRD

FIG.4)

1.3 CURRENT DATA		24/76
×	D/C SOL. OUTPUT	0.82 A
×	D/C SOL. MONITOR	0.88 A
×	CURRENT GEAR POS.	2 GEAR
×	SHIFT RANGE INDICATOR	-
×	OIL PRESS SW5(D/C)	ON
	OIL PRESS SW3(I/C)	
	OIL PRESS SW2(LC/B)	
	OIL PRESS SW1(FR/B)	
FIX PART FULL HELP GRPH RCRD		

FIG.5)

1.3 CURRENT DATA		24/76
✖	D/C SOL. OUTPUT	0.82 A
✖	D/C SOL. MONITOR	0.88 A
✖	CURRENT GEAR POS.	3 GEAR
✖	SHIFT RANGE INDICATOR	-
✖	OIL PRESS SW5(D/C)	ON
	OIL PRESS SW3(I/C)	
	OIL PRESS SW2(LC/B)	
	OIL PRESS SW1(FR/B)	
FIX	PART	FULL
HELP	GRPH	RCRD

FIG.6)

1.3 CURRENT DATA		24/76
×	D/C SOL. OUTPUT	0.82 A
×	D/C SOL. MONITOR	0.88 A
×	CURRENT GEAR POS.	4 GEAR
×	SHIFT RANGE INDICATOR	-
×	OIL PRESS SW5(D/C)	ON
	OIL PRESS SW3(I/C)	
	OIL PRESS SW2(LC/B)	
	OIL PRESS SW1(FR/B)	
FIX PART FULL HELP GRPH RCRD		

FIG.7)

1.3 CURRENT DATA		24/76
* D/C SOL. OUTPUT	0.69 A	
* D/C SOL. MONITOR	0.88 A	
* CURRENT GEAR POS.	5 GEAR	
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW5(D/C)	OFF	
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
OIL PRESS SW1(FR/B)		
FIX	PART	FULL
HELP	GRPH	RCRD

FIG.8)

FIG.1) "P" Range

FIG.2) "R" Shifting

FIG.3) "N" Range

FIG.4) "D" Range 1st gear

FIG.5) "D" Range 2nd gear

FIG.6) "D" Range 3rd gear

FIG.7) "D" Range 4th gear

FIG.8) "D" Range 5th gear

6. Does "D/C SOLENOID" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal&connector inspection " procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification of vehicle repair" procedure.

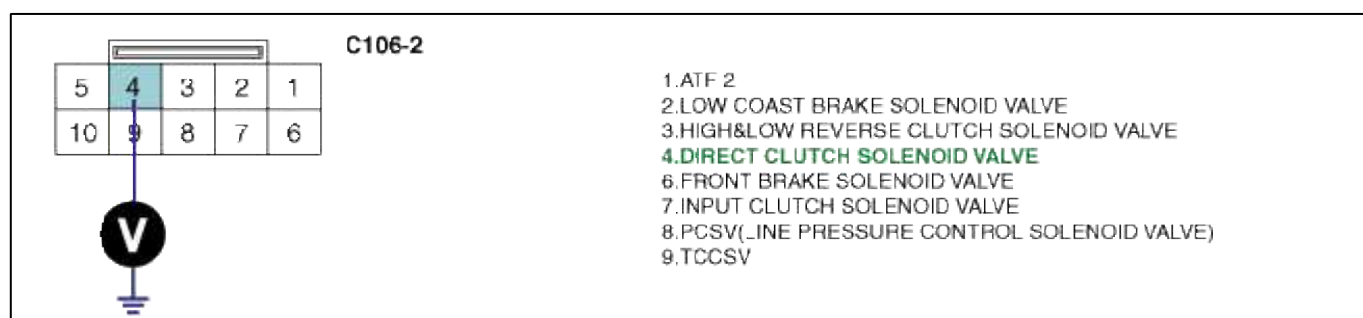
**NO**

Go to "Signal circuit Inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Disconnect "C106-2" connector.
2. IGNITION "ON", ENGINE "OFF"
3. Measure voltage between terminal "4" of the C106-2 harness connector and chassis ground.

Specification : approx. 5V



4. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

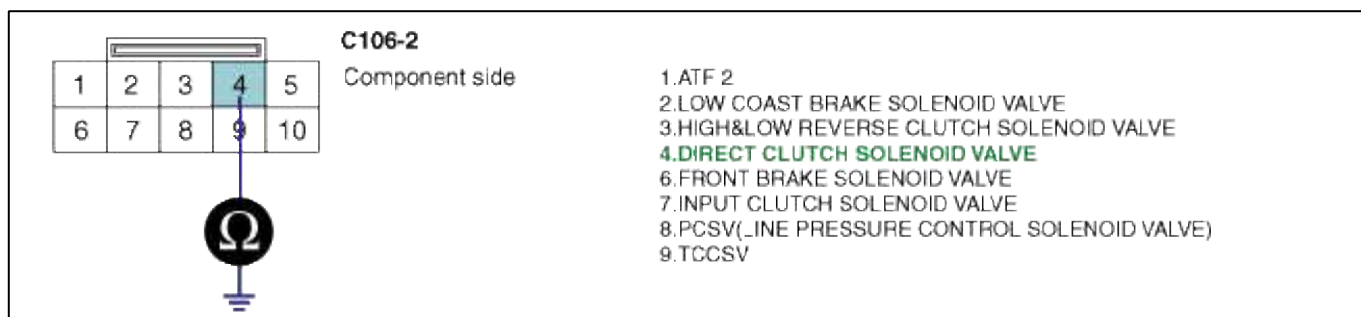
Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Disconnect "C106-2" connector.
2. Ignition "OFF".

3. Measure resistance between terminal "4" of the C106-2 harness connector and chassis ground.

Specification : approx. 3~9Ω



4. Is resistance within specifications?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

5. Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.  
If signal circuit in harness is OK, Replace "D/C SOLENOID VALVE" as necessary and Go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

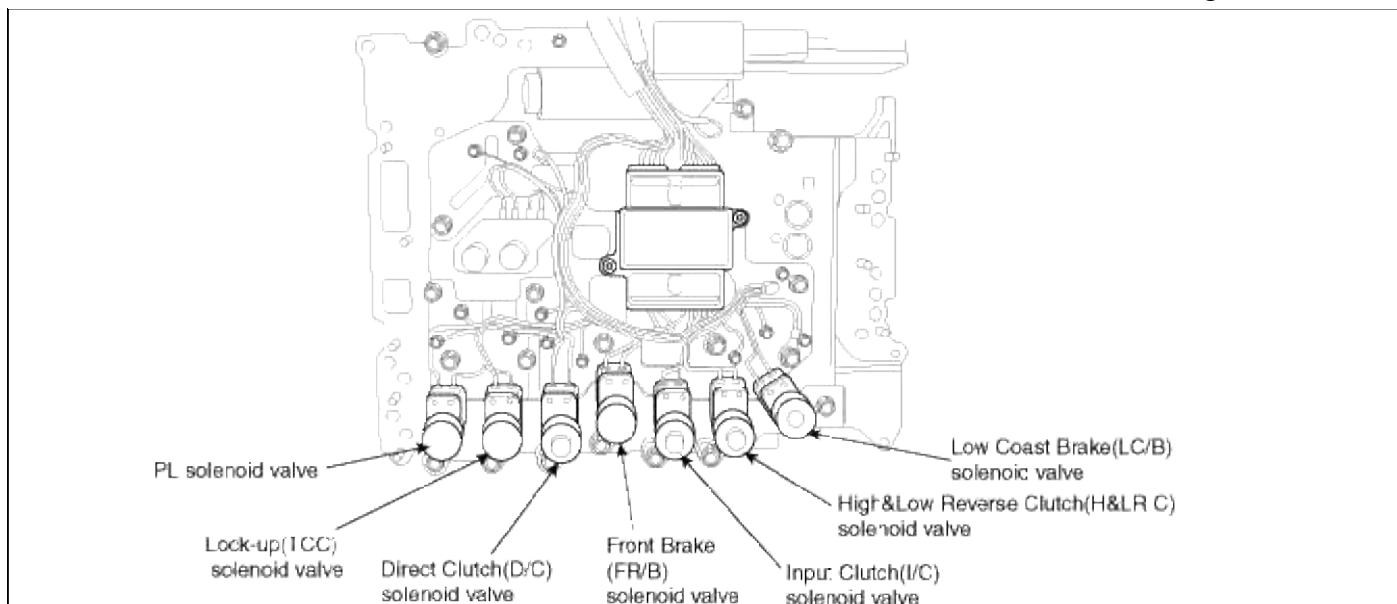
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

#### Automatic Transaxle System > Troubleshooting > P0768

#### COMPONENT LOCATION



## GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. High&low reverse clutch solenoid valve is controlled by the TCM in response to signals sent from the inhibitor switch, vehicle speed sensor and accelerator pedal position sensor (throttle position sensor). Gears will then be shifted to the optimum position.

## DTC DESCRIPTION

This is not only caused by electrical malfunction (circuits open or shorted) but also by mechanical malfunction such as control valve sticking, improper solenoid valve operation.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check voltage range	<b>HIGH&amp;LOW REVERSE CLUTCH SOLENOID VALVE: H&amp;LR/C SOLENOID VALVE</b> <ul style="list-style-type: none"> <li>• Open or short in circuit</li> <li>• Faulty H&amp;LR/C SOLENOID VALVE</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	• $10V < \text{Actuator power supply voltage} < 16V$	
<b>Threshold value</b>	• Hardware "IC" check	
<b>Diagnostic Time</b>	• More than 0.2sec	
<b>Fail Safe</b>	• Lock-up control is prohibited(L/U off)	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "H&LR/C SOLENOID" parameter on the scantool.
4. Select "D RANGE" and Operate the vehicle.



## 5. Check "H&amp;LR/C SOLENOID" parameter value changes while driving.

1.3 CURRENT DATA		26/76
× H&L R/C SOL. OUTPUT	0.01 A	
× H&L R/C SOL. MONITOR	0.00 A	
× CURRENT GEAR POS.	1	GEAR
× SHIFT RANGE INDICATOR	P	
× OIL PRESS SW6(H&L R/C)	ON	
OIL PRESS SW5(D/C)		
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
FIX PART FULL HELP GRPH RCRD		

FIG.1)

1.3 CURRENT DATA		26/76
× H&L R/C SOL. OUTPUT	0.01 A	
× H&L R/C SOL. MONITOR	0.00 A	
× CURRENT GEAR POS.	1	GEAR
× SHIFT RANGE INDICATOR	R	
× OIL PRESS SW6(H&L R/C)	ON	
OIL PRESS SW5(D/C)		
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
FIX PART FULL HELP GRPH RCRD		

FIG.2)

1.3 CURRENT DATA		26/76
× H&L R/C SOL. OUTPUT	0.01 A	
× H&L R/C SOL. MONITOR	0.00 A	
× CURRENT GEAR POS.	1	GEAR
× SHIFT RANGE INDICATOR	N	
× OIL PRESS SW6(H&L R/C)	ON	
OIL PRESS SW5(D/C)		
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
FIX PART FULL HELP GRPH RCRD		

FIG.3)

1.3 CURRENT DATA		26/76
× H&L R/C SOL. OUTPUT	0.66 A	
× H&L R/C SOL. MONITOR	0.00 A	
× CURRENT GEAR POS.	1	GEAR
× SHIFT RANGE INDICATOR	D	
× OIL PRESS SW6(H&L R/C)	OFF	
OIL PRESS SW5(D/C)		
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
FIX PART FULL HELP GRPH RCRD		

FIG.4)

1.3 CURRENT DATA		26/76
× H&L R/C SOL. OUTPUT	0.66 A	
× H&L R/C SOL. MONITOR	0.00 A	
× CURRENT GEAR POS.	2	GEAR
× SHIFT RANGE INDICATOR	-	
× OIL PRESS SW6(H&L R/C)	OFF	
OIL PRESS SW5(D/C)		
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
FIX PART FULL HELP GRPH RCRD		

FIG.5)

1.3 CURRENT DATA		26/76
× H&L R/C SOL. OUTPUT	0.01 A	
× H&L R/C SOL. MONITOR	0.00 A	
× CURRENT GEAR POS.	3	GEAR
× SHIFT RANGE INDICATOR	-	
× OIL PRESS SW6(H&L R/C)	ON	
OIL PRESS SW5(D/C)		
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
FIX PART FULL HELP GRPH RCRD		

FIG.6)

1.3 CURRENT DATA		26/76
× H&L R/C SOL. OUTPUT	0.01 A	
× H&L R/C SOL. MONITOR	0.00 A	
× CURRENT GEAR POS.	4	GEAR
× SHIFT RANGE INDICATOR	-	
× OIL PRESS SW6(H&L R/C)	ON	
OIL PRESS SW5(D/C)		
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
FIX PART FULL HELP GRPH RCRD		

FIG.7)

1.3 CURRENT DATA		26/76
× H&L R/C SOL. OUTPUT	0.01 A	
× H&L R/C SOL. MONITOR	0.00 A	
× CURRENT GEAR POS.	5	GEAR
× SHIFT RANGE INDICATOR	-	
× OIL PRESS SW6(H&L R/C)	ON	
OIL PRESS SW5(D/C)		
OIL PRESS SW3(I/C)		
OIL PRESS SW2(LC/B)		
FIX PART FULL HELP GRPH RCRD		

FIG.8)

FIG.1) "P" Range

FIG.2) "R" Shifting

FIG.3) "N" Range

FIG.4) "D" Range 1st gear

FIG.5) "D" Range 2nd gear

FIG.6) "D" Range 3rd gear

FIG.7) "D" Range 4th gear

FIG.8) "D" Range 5th gear

6. Does "H&LR/C SOLENOID" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal&connector inspection " procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification of vehicle repair" procedure.

**NO**

Go to "Signal circuit Inspection" procedure.

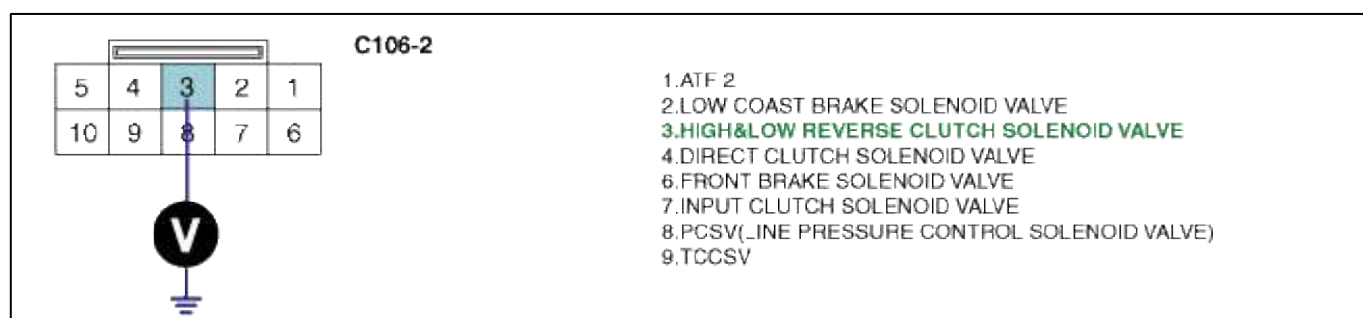
## SIGNAL CIRCUIT INSPECTION

1. Disconnect "C106-2" connector.
2. IGNITION "ON", ENGINE "OFF"
3. Measure voltage between terminal "3" of the C106-2 harness connector and chassis ground.

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Specification : Output voltage repeated between 4V and 12V

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4. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

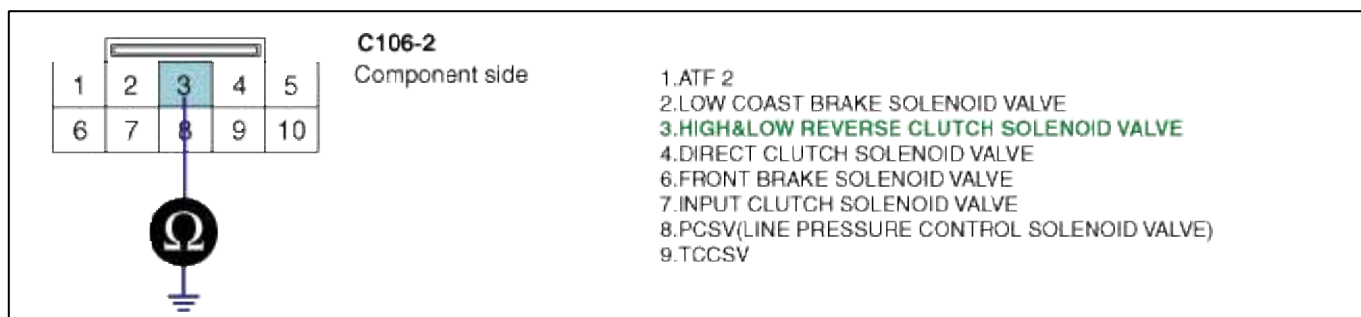
## COMPONENT INSPECTION

1. Disconnect "C106-2" connector.
2. Ignition "OFF".



3. Measure resistance between terminal "3" of the C106-2 harness connector and chassis ground.

Specification : approx. 3~9Ω



4. Is resistance within specifications?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

5. Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Replace "H&LR/C SOLENOID VALVE" as necessary and Go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

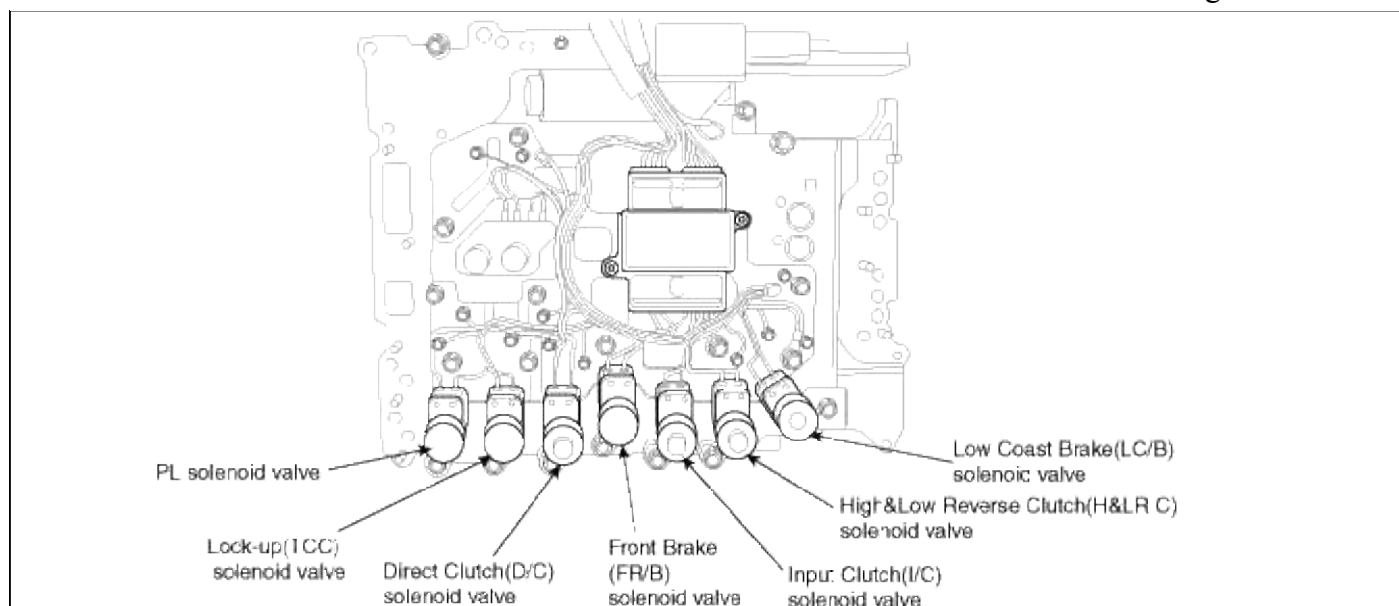
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

#### Automatic Transaxle System > Troubleshooting > P0773

#### COMPONENT LOCATION



## GENERAL DESCRIPTION

Low coast brake solenoid valve is turned "ON" or "OFF" by the TCM in response to signals sent from the inhibitor switch, vehicle speed sensor and accelerator pedal position sensor (throttle position sensor). Gears will then be shifted to the optimum position.

## DTC DESCRIPTION

This is not only caused by electrical malfunction (circuits open or shorted) but also by mechanical malfunction such as control valve sticking, improper solenoid valve operation.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check voltage range	<b>LOW COAST BRAKE SOLENOID VALVE: LC/B SOLENOID VALVE</b> <ul style="list-style-type: none"> <li>• Open or short in circuit</li> <li>• Faulty LC/B SOLENOID VALVE</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	• 10V < Actuator power supply voltage < 16V	
<b>Threshold value</b>	• Hardware "IC" check	
<b>Diagnostic Time</b>	• More than 0.2sec	
<b>Fail Safe</b>	• Lock-up control is prohibited(L/U off)	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "LC/B SOLENOID" parameter on the scantool.
4. Select "D RANGE" and Operate the vehicle.

## 5. Check "LC/B SOLENOID" parameter value changes while driving.

1.3 CURRENT DATA			28/76
* LC/B SOLENOID	OFF		
* LC/B SOL. MONITOR	ON		
* CURRENT GEAR POS.	1	GEAR	
* SHIFT RANGE INDICATOR	P		
* OIL PRESS SW2(LC/B)	OFF		
OIL PRESS SW1(FR/B)			
BRAKE SWITCH			
REVERSE LAMP			
FIX	PART	FULL	
HELP	GRPH	CRD	

FIG.1)

1.3 CURRENT DATA		28/76
* LC/B SOLENOID	OFF	
* LC/B SOL. MONITOR	ON	
* CURRENT GEAR POS.	1	GEAR
* SHIFT RANGE INDICATOR	R	
* OIL PRESS SW2(LC/B)	OFF	
OIL PRESS SW1(FR/B)		
BRAKE SWITCH		
REVERSE LAMP		
FIX	PART	FULL
HELP	GRPH	RCRD

FIG.2)

1.3 CURRENT DATA		28/76			
* LC/B SOLENOID	OFF	▲  ■  ▼			
* LC/B SOL. MONITOR	ON				
* CURRENT GEAR POS.	1		GEAR		
* SHIFT RANGE INDICATOR	N				
* OIL PRESS SW2(LC/B)	OFF				
OIL PRESS SW1(FR/B)					
BRAKE SWITCH					
REVERSE LAMP					
FIX	PART	FULL	HELP	GRPH	RCRD

FIG.3)

1.3 CURRENT DATA			28/76
* LC/B SOLENOID	OFF		
* LC/B SOL. MONITOR	ON		
* CURRENT GEAR POS.	1	GEAR	
* SHIFT RANGE INDICATOR	D		
* OIL PRESS SW2(LC/B)	OFF		
OIL PRESS SW1(FR/B)			
BRAKE SWITCH			
REVERSE LAMP			
FIX	PART	FULL	
HELP	GRPH	RCRD	

FIG.4)

1.3 CURRENT DATA			28/76
* LC/B SOLENOID	ON		
* LC/B SOL. MONITOR	OFF		
* CURRENT GEAR POS.	2	GEAR	
* SHIFT RANGE INDICATOR	-		
* OIL PRESS SW2(LC/B)	ON		
OIL PRESS SW1(FR/B)			
BRAKE SWITCH			
REVERSE LAMP			
FIX	PART	FULL	
HELP	GRPH	RCRD	

FIG.5)

1.3 CURRENT DATA		28/76
* LC/B SOLENOID	OFF	
* LC/B SOL. MONITOR	ON	
* CURRENT GEAR POS.	3	GEAR
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW2(LC/B)	OFF	
OIL PRESS SW1(FR/B)		
BRAKE SWITCH		
REVERSE LAMP		
FIX	PORT	FULL HELP GRPH RCRD

FIG.6)

1.3 CURRENT DATA			28/76
* LC/B SOLENOID	OFF		
* LC/B SOL. MONITOR	ON		
* CURRENT GEAR POS.	4	GEAR	
* SHIFT RANGE INDICATOR	-		
* OIL PRESS SW2(LC/B)	OFF		
OIL PRESS SW1(FR/B)			
BRAKE SWITCH			
REVERSE LAMP			
FIX	PART	FULL	
HELP	GRPH	RCRD	

FIG.7)

1.3 CURRENT DATA		28/76
* LC/B SOLENOID	OFF	
* LC/B SOL. MONITOR	ON	
* CURRENT GEAR POS.	5	GEAR
* SHIFT RANGE INDICATOR	-	
* OIL PRESS SW2(LC/B)	OFF	
OIL PRESS SW1(FR/B)		
BRAKE SWITCH		
REVERSE LAMP		
FIX	PART	FULL
HELP	GRPH	RCRD

FIG.8)

FIG.1) "P" Range

FIG.2) "R" Shifting

FIG.3) "N" Range

FIG.4) "D" Range 1st gear

FIG.5) "D" Range 2nd gear

FIG.6) "D" Range 3rd gear

FIG.7) "D" Range 4th gear

FIG.8) "D" Range 5th gear

6. Does "LC/B SOLENOID" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal&connector inspection " procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification of vehicle repair" procedure.

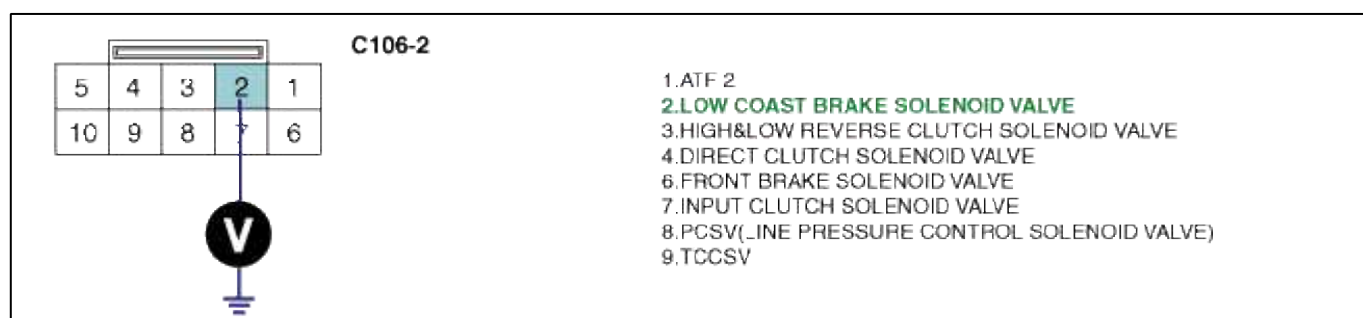
**NO**

Go to "Signal circuit Inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Disconnect "C106-2" connector.
2. IGNITION "ON", ENGINE "OFF"
3. Measure voltage between terminal "2" of the C106-2 harness connector and chassis ground.

Specification : approx. 12V



4. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

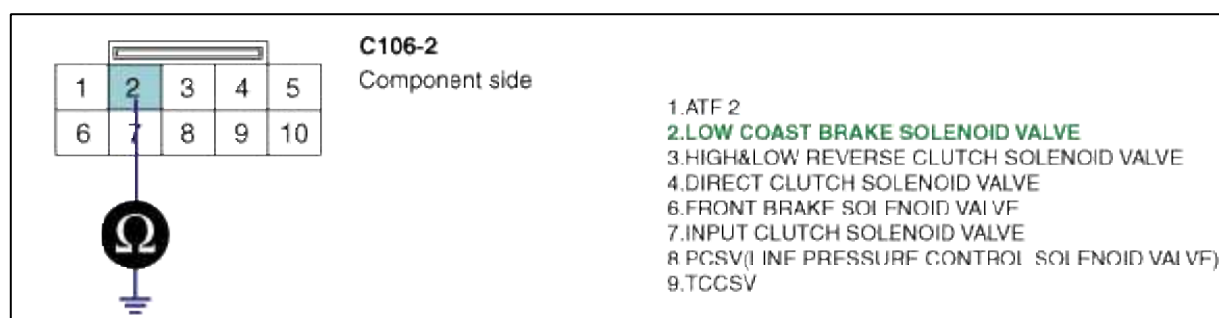
Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Substitute with a known-good TCM and check for proper operation. If the problem is corrected, replace TCM as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Disconnect "C106-2" connector.
2. Ignition "OFF".

3. Measure resistance between terminal "2" of the C106-2 harness connector and chassis ground.

Specification : approx. 3~9Ω



4. Is resistance within specifications?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

5. Check for open or short in harness. Repair as necessary and Go to "Verification of Vehicle Repair" procedure. If signal circuit in harness is OK, Replace "LC/B SOLENOID VALVE" as necessary and Go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

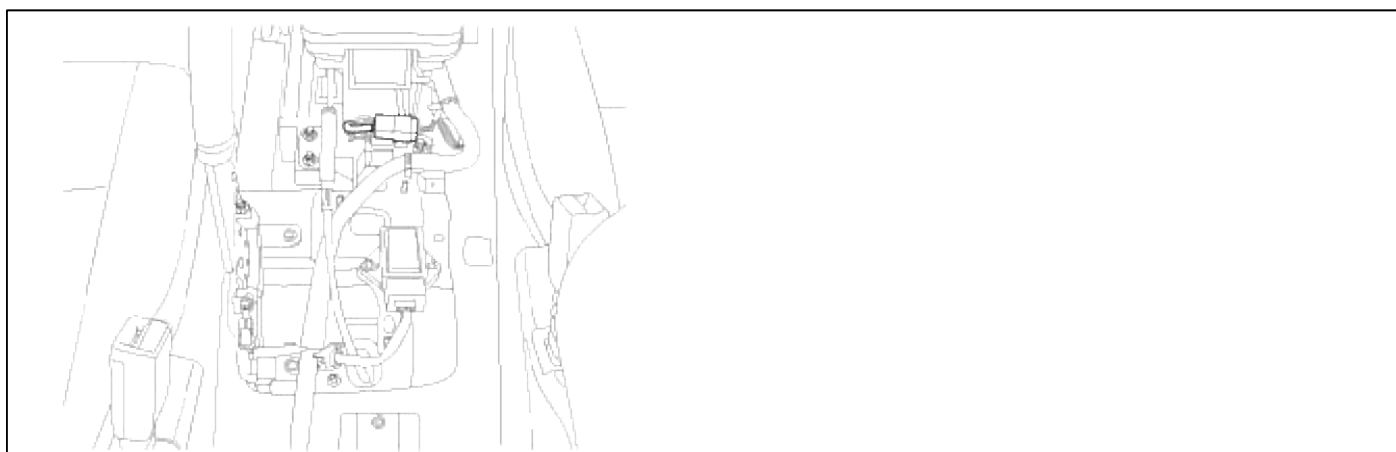
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > P0819

### COMPONENT LOCATION



## GENERAL DESCRIPTION

When the shift lever is in the D (Drive) position the output signal of Tansaxle Range Switch is 12V and in all other positions the voltage is 0V. The TCM judges the shift lever position by reading all signals, for the TRANSMISSION Range Switch, simultaneously.

## DTC DESCRIPTION

The TCM sets this code when patterns are out of specifications.

The TRANSMISSION Range Switch has no output signal for an extended period of time.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Rationality	<ul style="list-style-type: none"> <li>• OPEN OR SHORT IN CIRCUIT</li> <li>• Faulty TRANSMISSION RANGE SWITCH</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	• Battery voltage >10V	
<b>Threshold value</b>	• Abnormal input signal is detected.	
<b>Diagnostic Time</b>	• More than 5sec	
<b>Fail Safe</b>	• Prevention of manual shift	

## Monitor Scantool Data

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "SPORTS MODE SELECT S/W, SPORTS MODE UP S/W, SPORTS MODE DOWN S/W " parameter on the scantool.
4. Move selector lever to "SPORTS MODE".

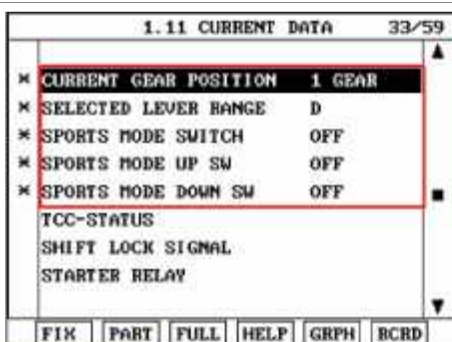


FIG.1)

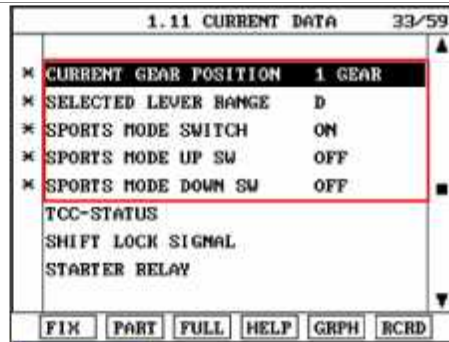


FIG.2)

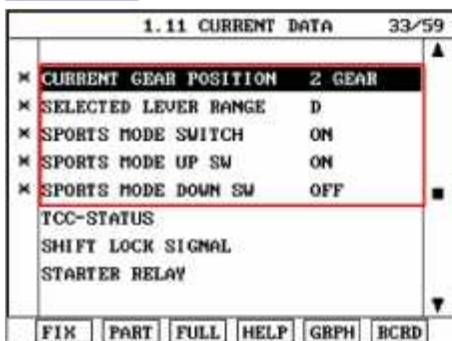


FIG.3)

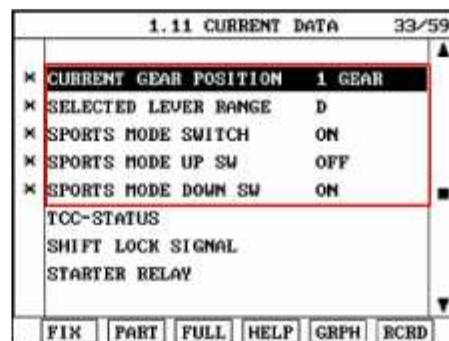


FIG.4)

FIG.1) "D" RANGE

FIG.2) "SPORTS MODE ON"

FIG.3) "UP S/W ON"

FIG.4) "DOWN S/W ON"

5. Does "SPORTS MODE SELECT S/W" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Power supply circuit inspection" procedure.

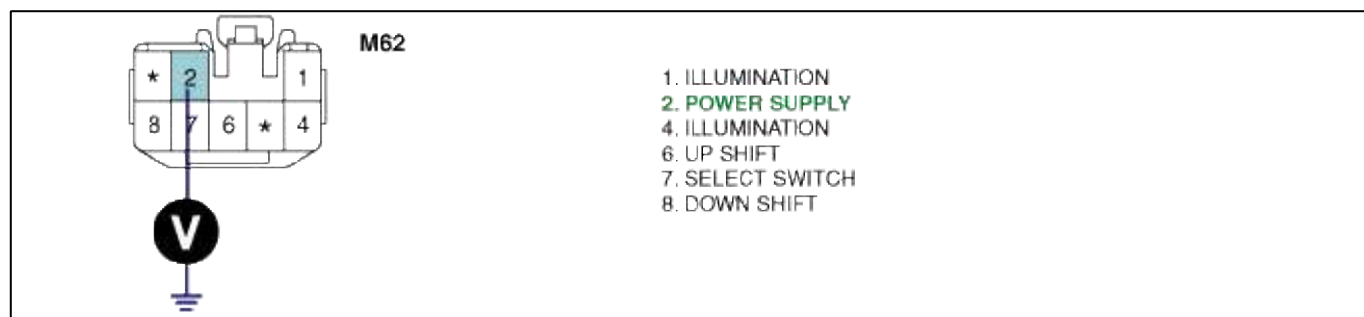
## Power supply circuit inspection

1. Connect "M62" connector.
2. Ignition "ON" & Engine "OFF"



3. Measure voltage between terminal "2" of the "M62" connector and chassis ground.

Specification : approx. 12V



4. Is voltage within specifications?

**YES**

Go to "Signal circuit inspection" procedure.

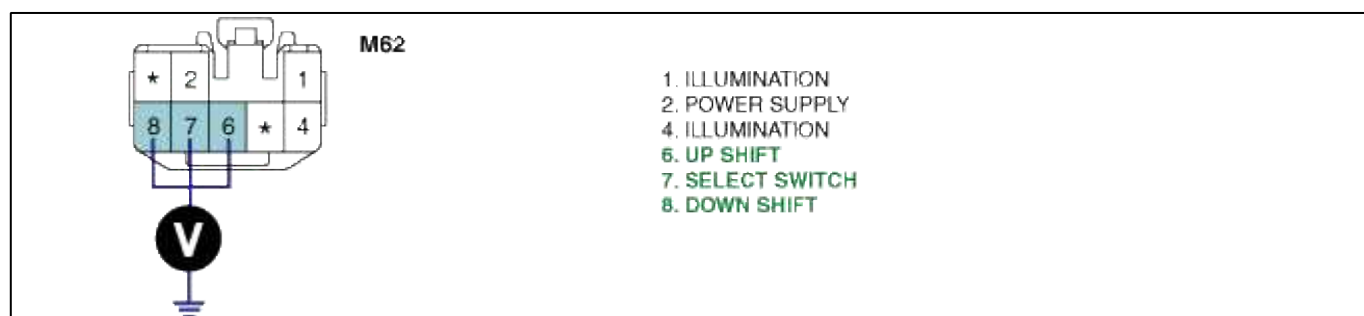
**NO**

Check for open or short in harness and Fuse. Repair as necessary and Go to "Verification of Vehicle Repair" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Connect "M62" connector.
2. Ignition "ON" & Engine "OFF".
3. Move select lever to "SPORTS MODE" and operate select lever to up and down.
4. Measure voltage between terminal "6, 7, 8" of the "M62" connector and chassis ground

Specification : approx. 12V



5. Is voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Substitute with a known-good "SPORTS MODE SWITCH" and check for proper operation. If the problem is corrected, replace "SPORTS MODE SWITCH" and Go to "Verification of Vehicle Repair" procedure.

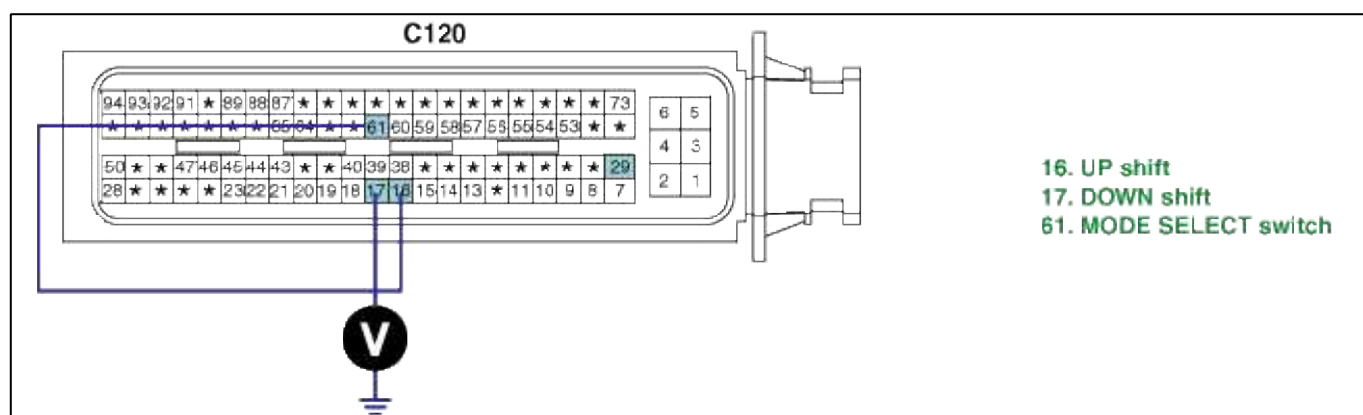
#### COMPONENT INSPECTION

1. Connect "TCU" connector.
2. Ignition "ON" & Engine "OFF".
3. Move select lever to "SPORTS MODE" and operate select lever to up and down.



4. Measure voltage between terminal "16, 17, 61" of the "TCU" connector(C120) and chassis ground.

Specification : approx. 12V



5. Is voltage within specifications?

**YES**

Substitute with a known-good "TCU" and check for proper operation. If the problem is corrected, replace "TCU" and Go to "Verification of Vehicle Repair" procedure.

**NO**

Check for open or short between "M62" and "C120" harness . Repair as necessary and Go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

**YES**

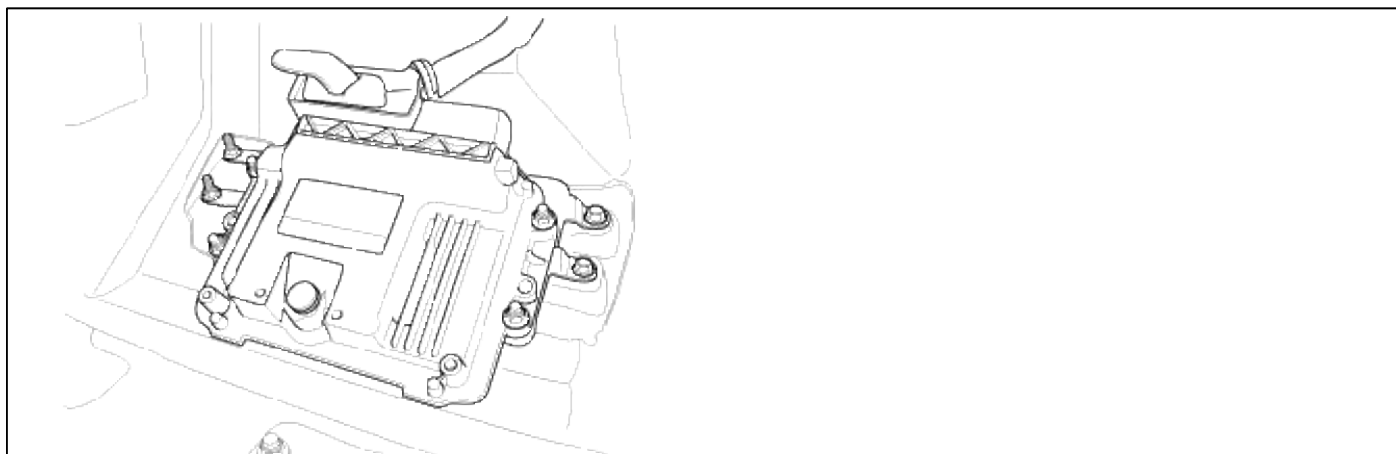
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Automatic Transaxle System > Troubleshooting > U0100

### COMPONENT LOCATION



## GENERAL DESCRIPTION

The TCM can either receive data from the Engine Control Module or ABS control module, or it can send data to the ECM and ABSCM by using CAN communication.

## DTC DESCRIPTION

CAN (Controller Area Network) is a serial communication line for real time application. It is an on-vehicle multiplex communication line with high data communication speed and excellent malfunction detection ability.

In CAN communication, control units are connected with 2 communication lines (CAN H line, CAN L line) allowing a high rate of information transmission with less wiring.

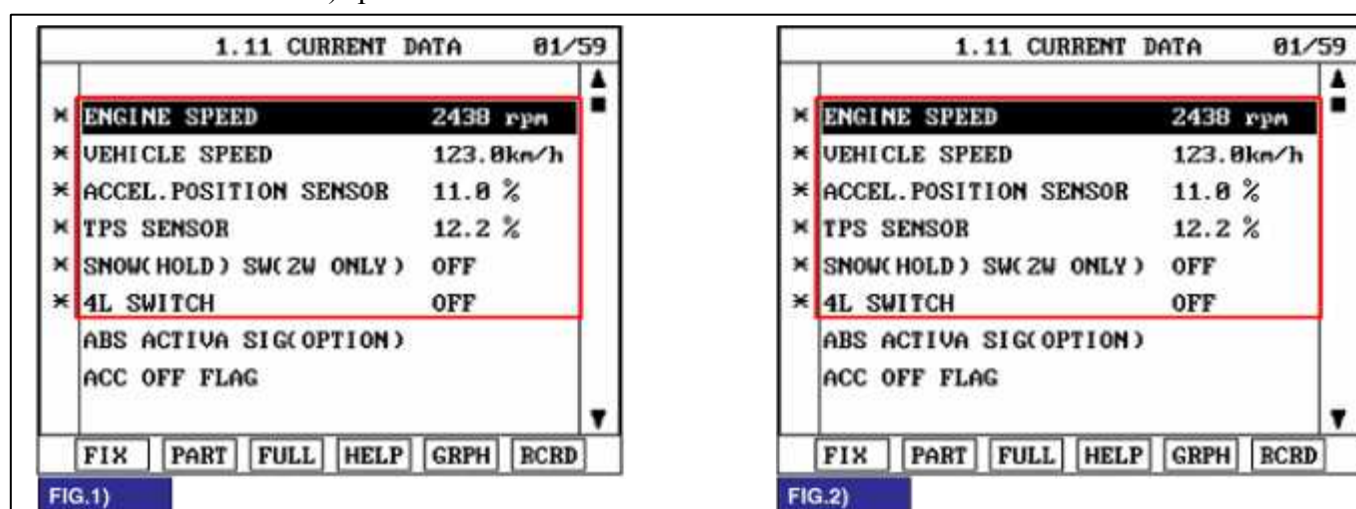
Each control unit transmits/receives data but selectively reads required data only.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
<b>DTC Strategy</b>	• Check voltage range	<ul style="list-style-type: none"> <li>• Open or Short in CAN communication harness</li> <li>• Faulty ECM</li> <li>• Faulty TCM</li> </ul>
<b>Enable Conditions</b>	<ul style="list-style-type: none"> <li>• IG "ON"</li> <li>• Battery voltage &gt; 10V</li> <li>• Input speed &gt; 300rpm</li> </ul>	
<b>Threshold value</b>	• Lost communication	
<b>Diagnostic Time</b>	• More than 500msec	
<b>Fail Safe</b>	• Default value	

## Monitor Scantool Data

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, VEHICLE SPEED SENSOR, THROTTLE P. SENSOR)" parameters on the scantool.



4. Does "CAN BUS LINE DATA" follow the reference data?

**YES**

Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Terminal & connector inspection" procedure.

## TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal conditions. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

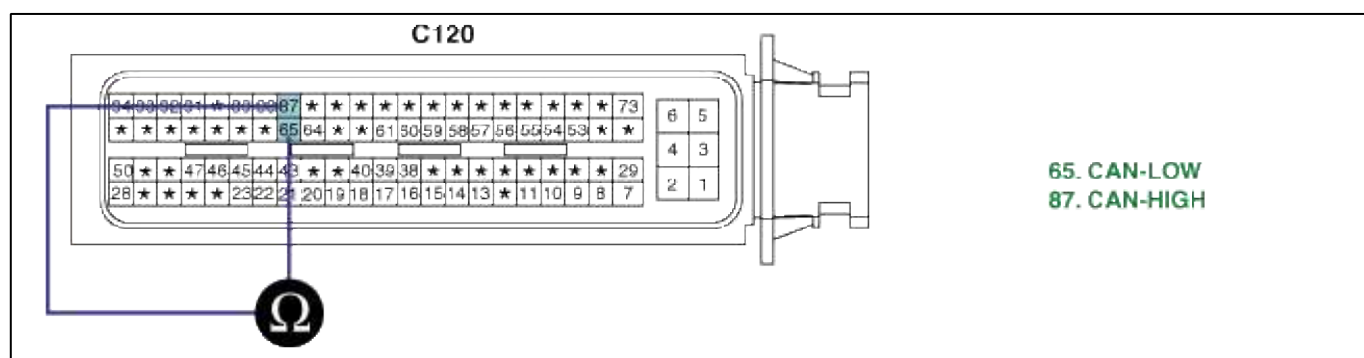
**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect the "TCM" connector.
3. Measure resistance between terminal "65" and "87" of the "TCM" harness connector.

Specification : Approx. 120Ω



4. Is measured resistance within specifications?

**YES**

Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage of ECM and then Repair or replace Resistance for CAN communication as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.

3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

SORENTO(BL) > 2007 > G 3.3 DOHC > Body (Interior and Exterior)

Body (Interior and Exterior) > Interior > console > Repair procedures

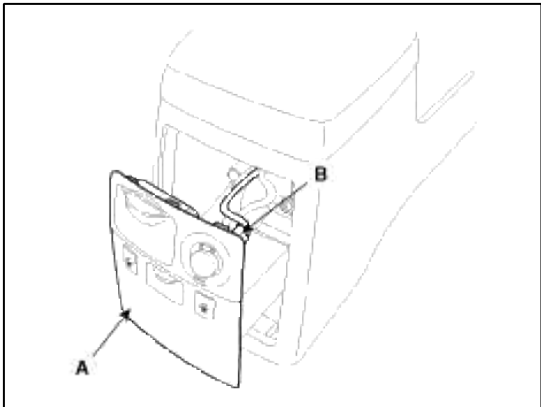
REPLACEMENT

FLOOR CONSOLE REPLACEMENT

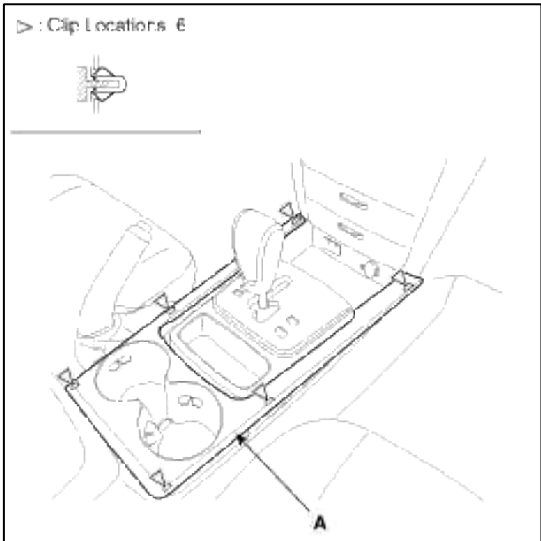
NOTE

- When prying with a flat-tipped screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damaged.
- Put on gloves to protect your hands.

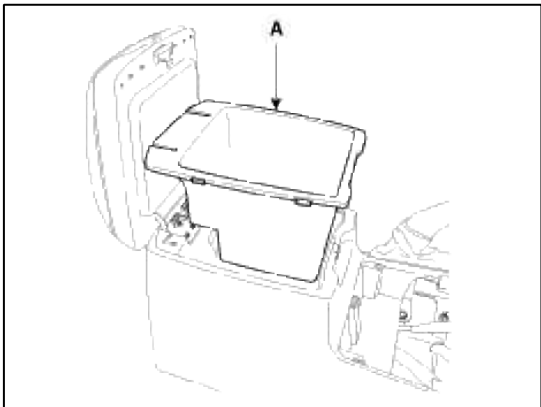
1. Remove the console lid cover (A).
2. Disconnect the connector (B).



3. Remove the deco upper panel (A).



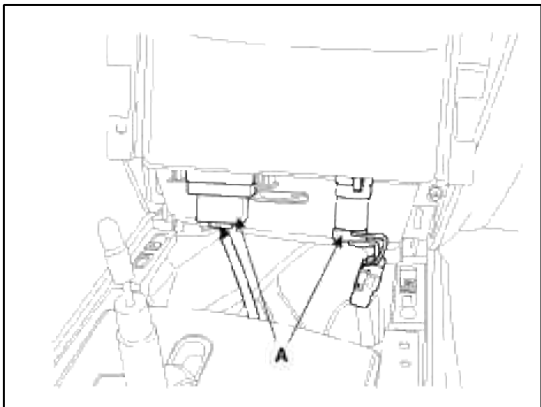
4. Remove the console storage box (A).



5. Remove the console upper cover (A).

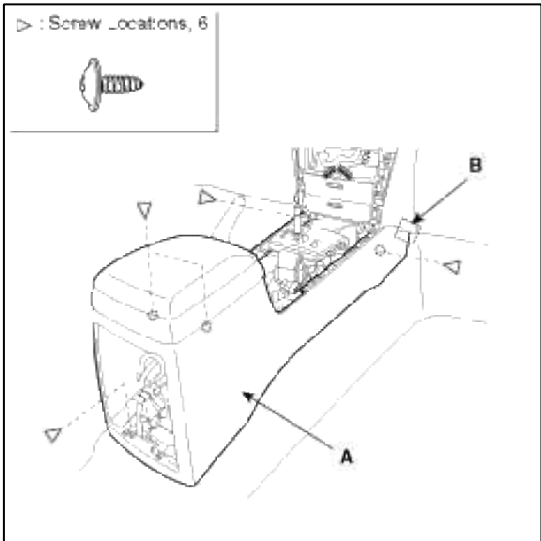


6. Disconnect the connector (A).



7. After loosening the console mounting screw, remove the floor console side cover (A).

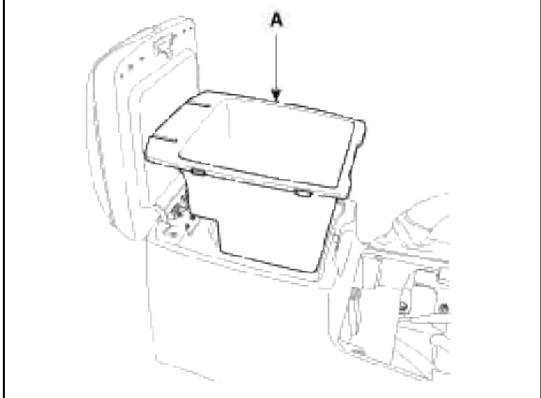
8. Disconnect the connector (B).



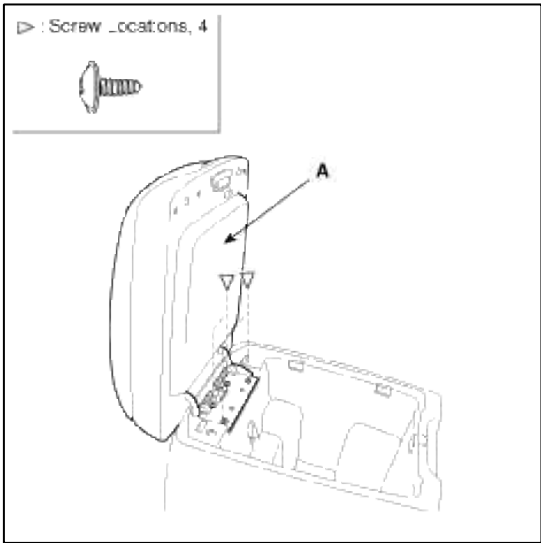
9. Installation is the reverse of removal.

ARMREST REPLACEMENT

1. Remove the console storage box (A).



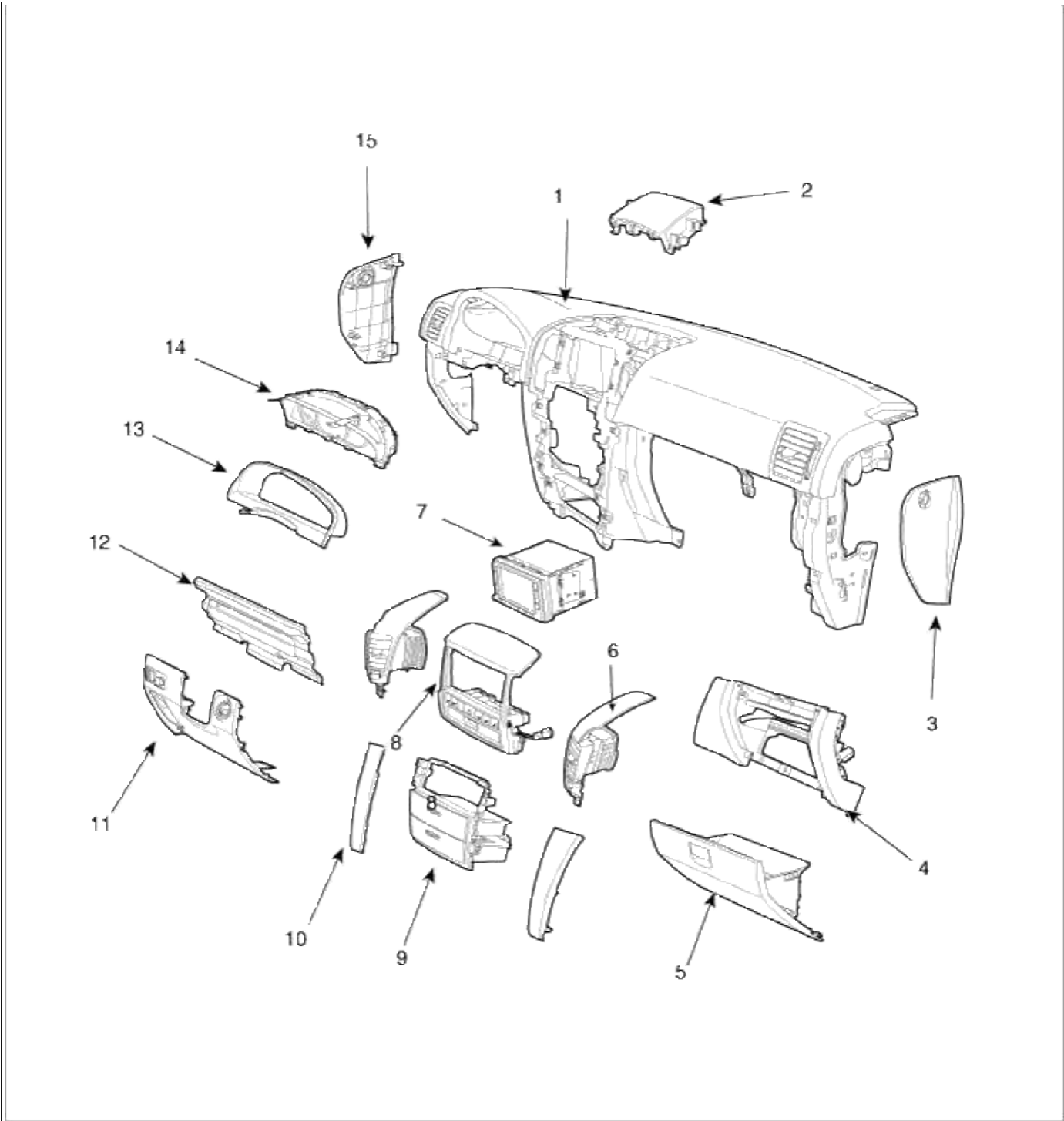
2. After loosening the armrest mounting nuts, remove the armrest (A).



3. Installation is the reverse of removal.

**Body (Interior and Exterior) > Interior > crash pad > Components and Components Location**

COMPONENTS



- |                              |                                    |                                 |
|------------------------------|------------------------------------|---------------------------------|
| 1. Crash pad                 | 6. Center fascia side upper panel  | 11. Crash pad drive lower panel |
| 2. Center fascia upper panel | 7. Audio                           | 12. Reinforce panel             |
| 3. Crash pad side cover      | 8. Audio fascia panel              | 13. Cluster fascia panel        |
| 4. Glove box housing         | 9. Center fascia lower panel       | 14. Cluster                     |
| 5. glove box                 | 10. Center fascia side lower panel | 15. Crash pad side cover        |

Body (Interior and Exterior) > Interior > crash pad > Repair procedures

REPLACEMENT

CLUSTER REPLACEMENT

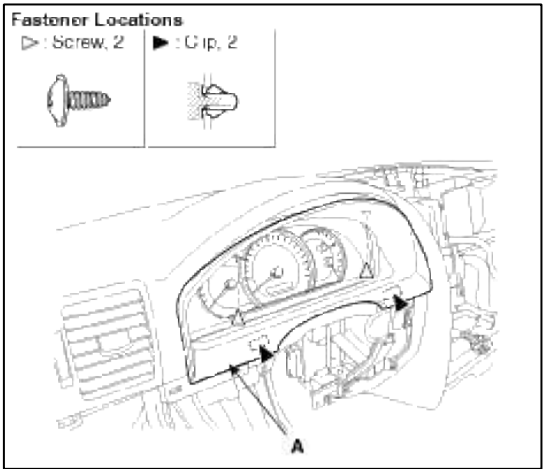
NOTE

- When prying with a flat-tipped screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damaged.
- Put on gloves to protect your hands.

1. Tilt the steering column down.

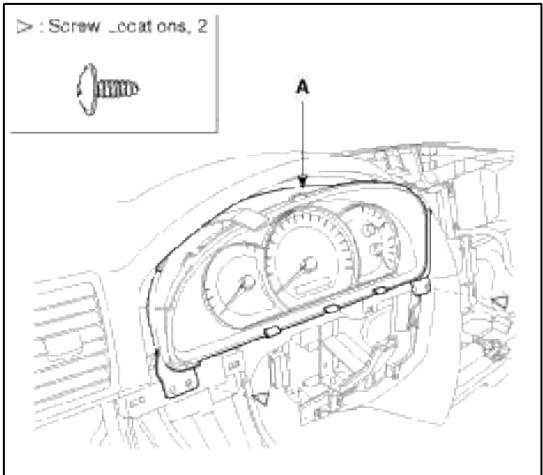


2. Remove the cluster fascia panel (A).

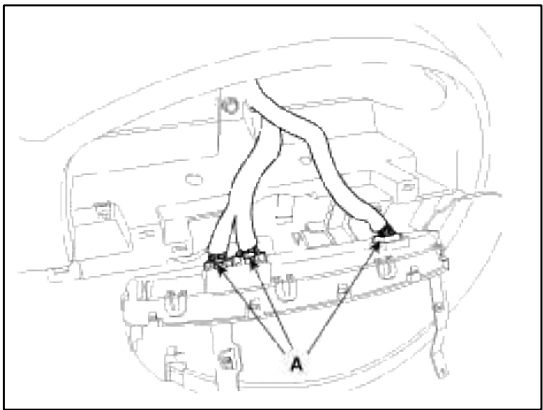


3. Loosen the screws.

4. Remove the cluster (A).



5. Disconnect the cluster connector (A), then remove the cluster (B).



6. Installation is the reverse of removal.

**NOTE**

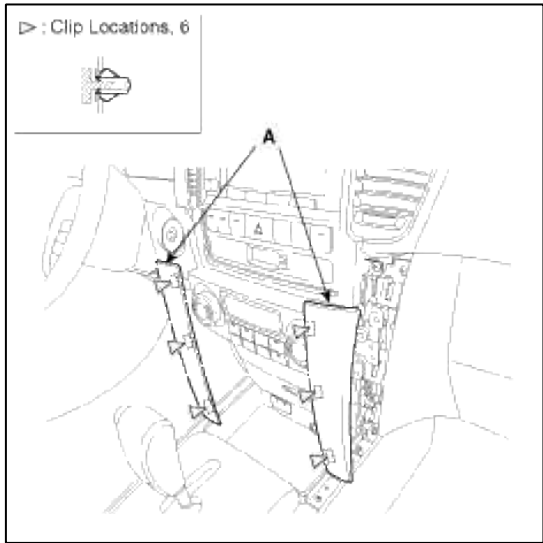
- Make sure the connector are plugged in properly.

**CENTER FASCIA PANEL REPLACEMENT**

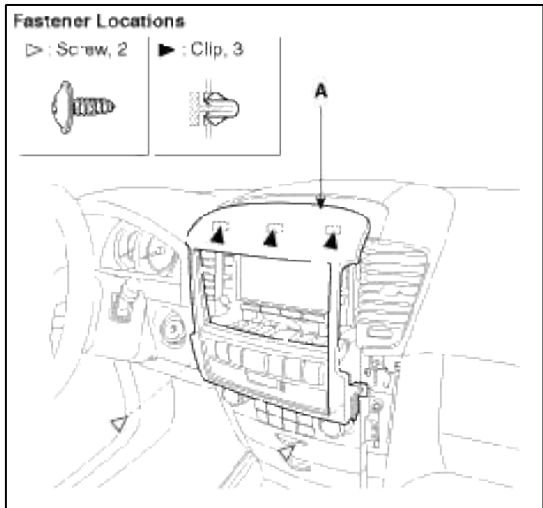
**NOTE**

- When prying with a flat-tipped screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damaged.
- Put on gloves to protect your hands.

1. Remove the side garnish (A).



2. After loosening the mounting screw, remove the center fascia panel (A).



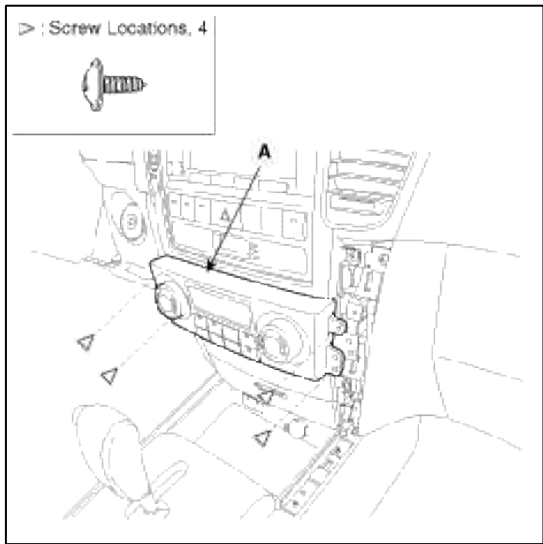
3. Installation is the reverse of removal.

**NOTE**

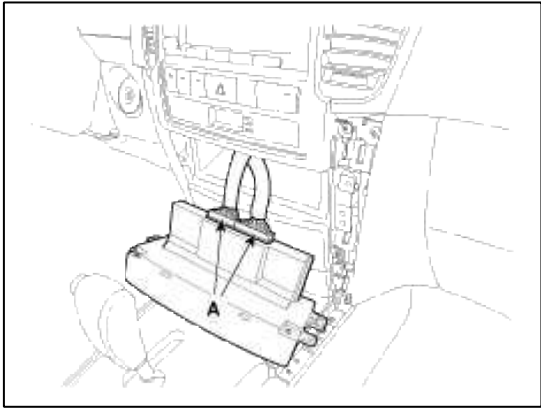
- Make sure the connector are plugged in properly.

**HEATER CONTROL UNIT REPLACEMENT**

1. Remove the side garnish.
2. After loosening the heater control mounting screw, remove the heater control unit (A).



3. Disconnect the connector (A).



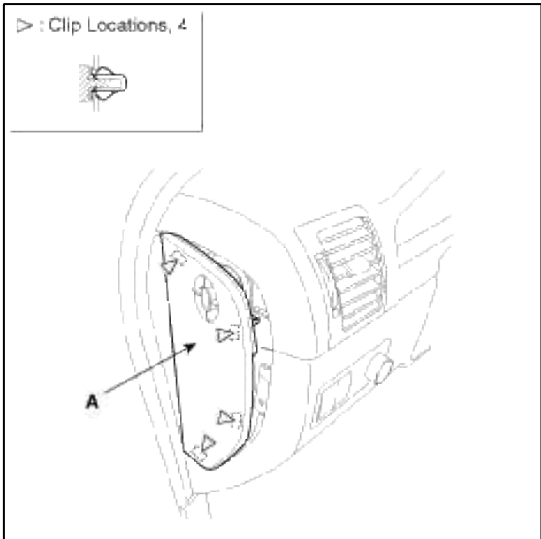
4. Installation is the reverse of removal.

NOTE

- Make sure the connector is plugged in properly.

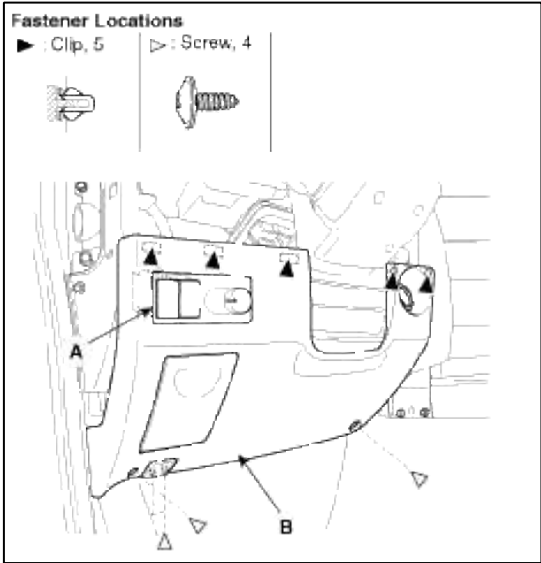
LOWER PANEL REPLACEMENT

1. Remove the crash pad side cover (A).



2. Loosen the mounting screw, remove the lower panel (B).

3. Disconnect the connector (A).



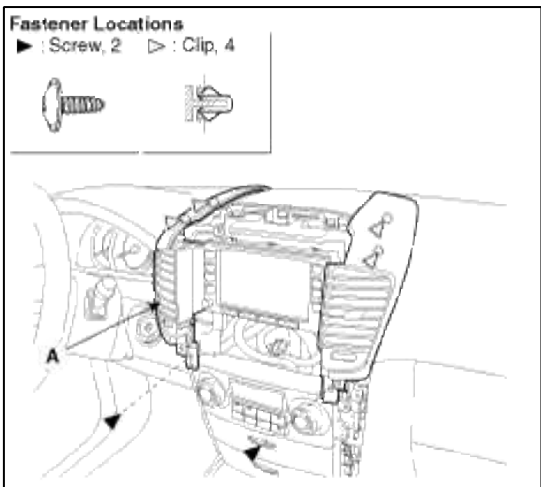
4. Remove the reinforcing panel (A).



5. Installation is the reverse of removal.

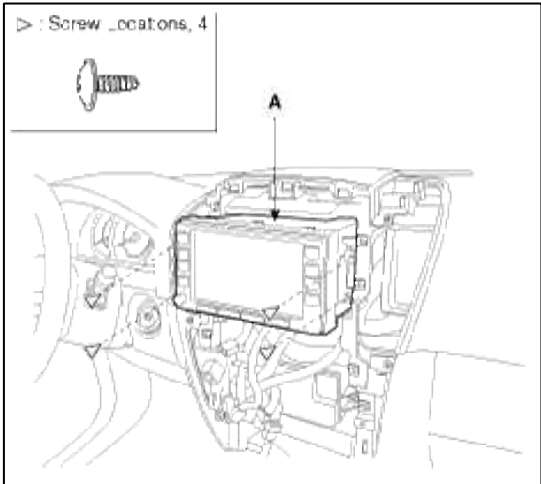
AUDIO ASSEMBLY REPLACEMENT

- 1. Remove the center fascia panel
- 2. Remove the center air vent(A).

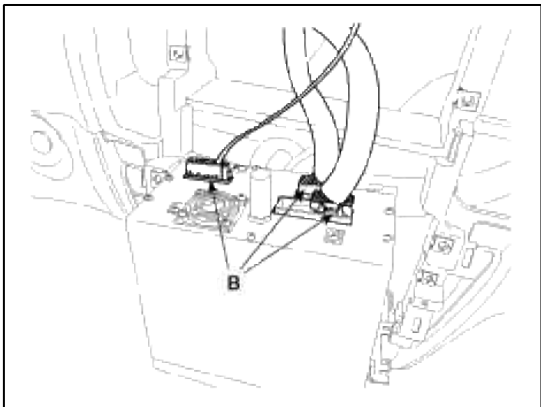


3. Loosen the screws.

4. Remove the audio assembly (A).



5. Disconnect the connector (B).



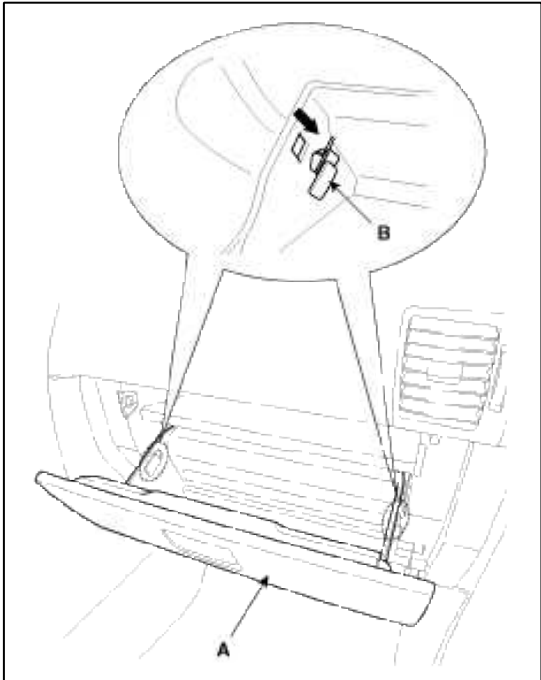
6. Installation is the reverse of removal.

NOTE

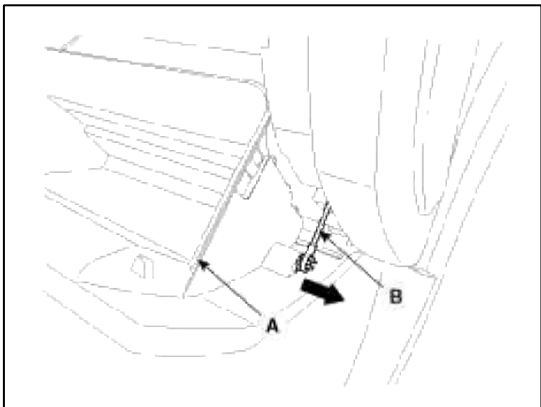
- Make sure the connector are plugged in properly.

GLOVE BOX REPLACEMENT

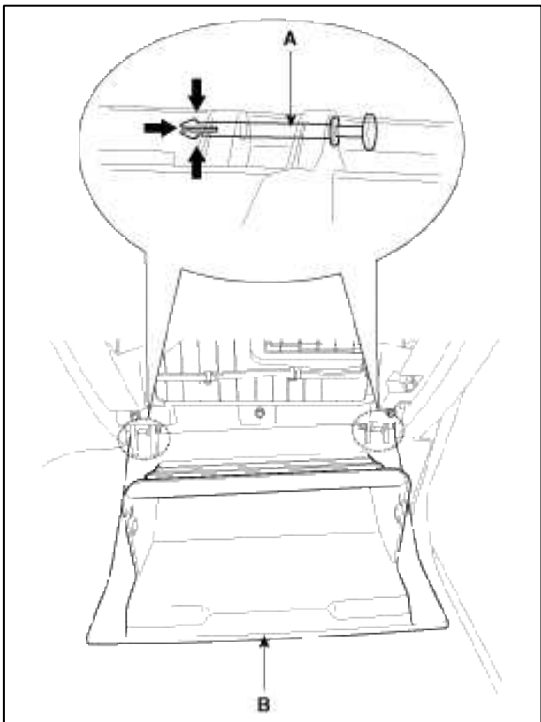
1. Disconnect the damper (B) from the glove box (A).



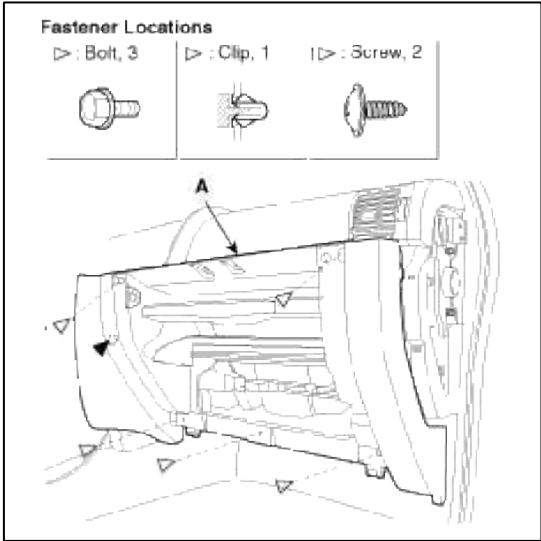
2. Remove the glove box (A) from the lift (B).



3. Disconnect the pin (A), then remove the glove box (C).



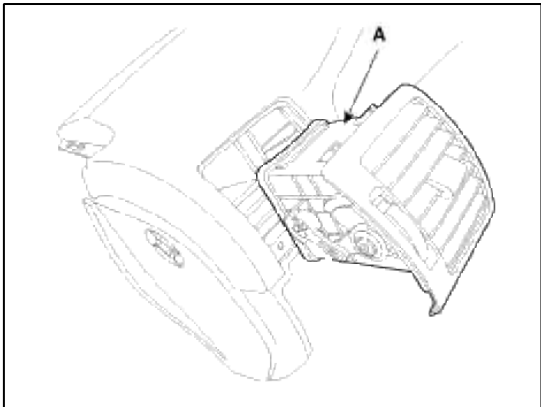
4. Remove the glove box housing (A).



5. Installation is the reverse of removal.

AIR VENT REPLACEMENT

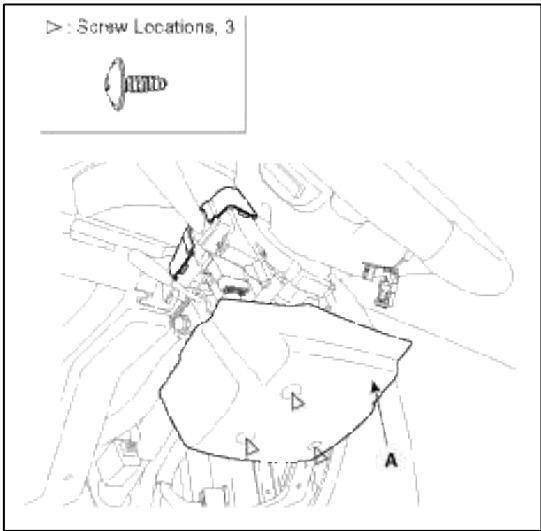
1. After loosening the mounting screw, then remove the air vent (A).



2. Installation is the reverse of removal.

SHROUD REPLACEMENT

1. Loosen the screws, then remove the shroud assembly (A).



2. Installation is the reverse of removal.

CRASH PAD REPLACEMENT

NOTE

- When prying with a flat-tipped screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damaged.
- Put on gloves to protect your hands.

1. Remove the following items.
  - A. Front seat.
  - B. Cluster facia panel and cluster.
  - C. Audio assembly.
  - D. Glove box.
  - E. Lower panel.
  - F. Front pillar trim.
2. Remove the photo sensor.
3. Disconnect the passenger's air bag connector (A). Loosen the bolt and nut, then remove the crash pad (B).
4. Installation is the reverse of removal.

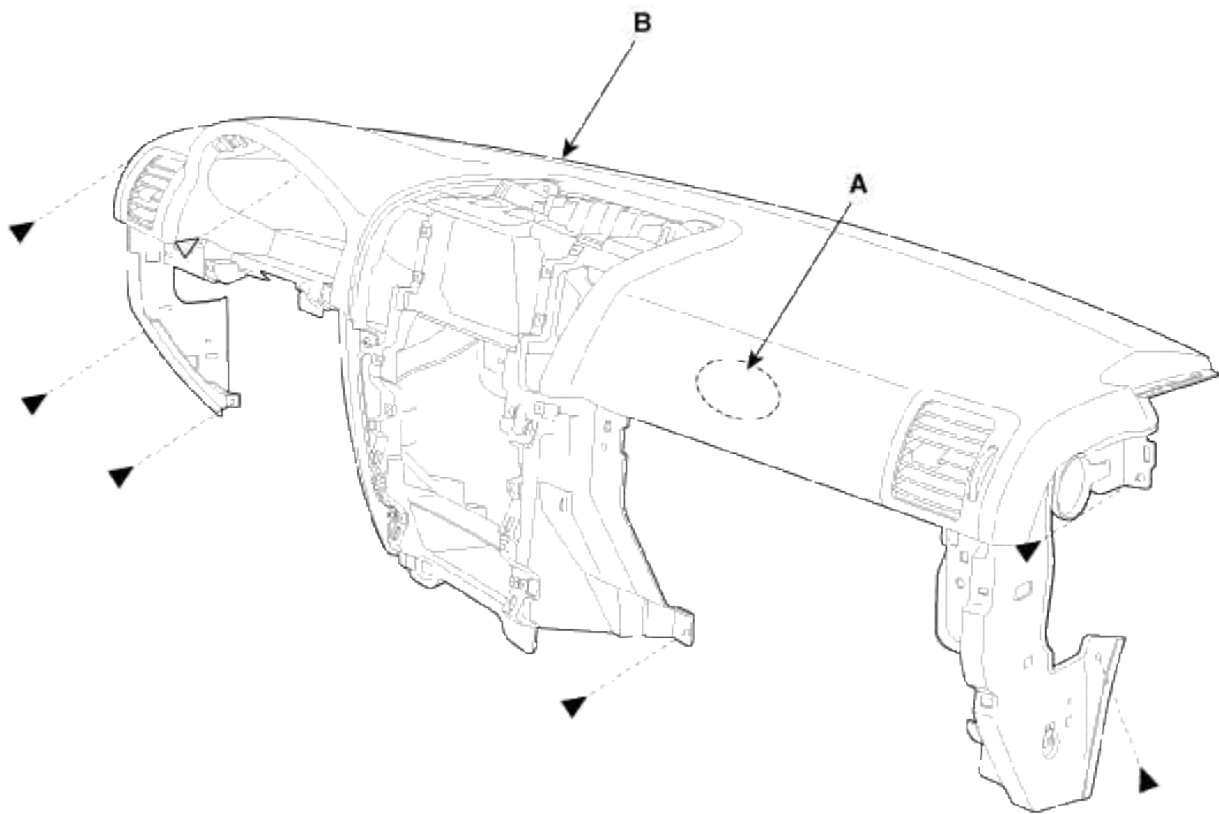
**NOTE**

- Make sure the crash pad fits onto the guide pins correctly.
- Before tightening the bolts, make sure the crash pad wire harnesses are not pinched.
- Make sure the connectors are plugged in prop-erly, and the antenna lead is connected properly.
- Enter the anti- theft code for the radio, then enter the customer's radio station presets.

**Fastener Locations**

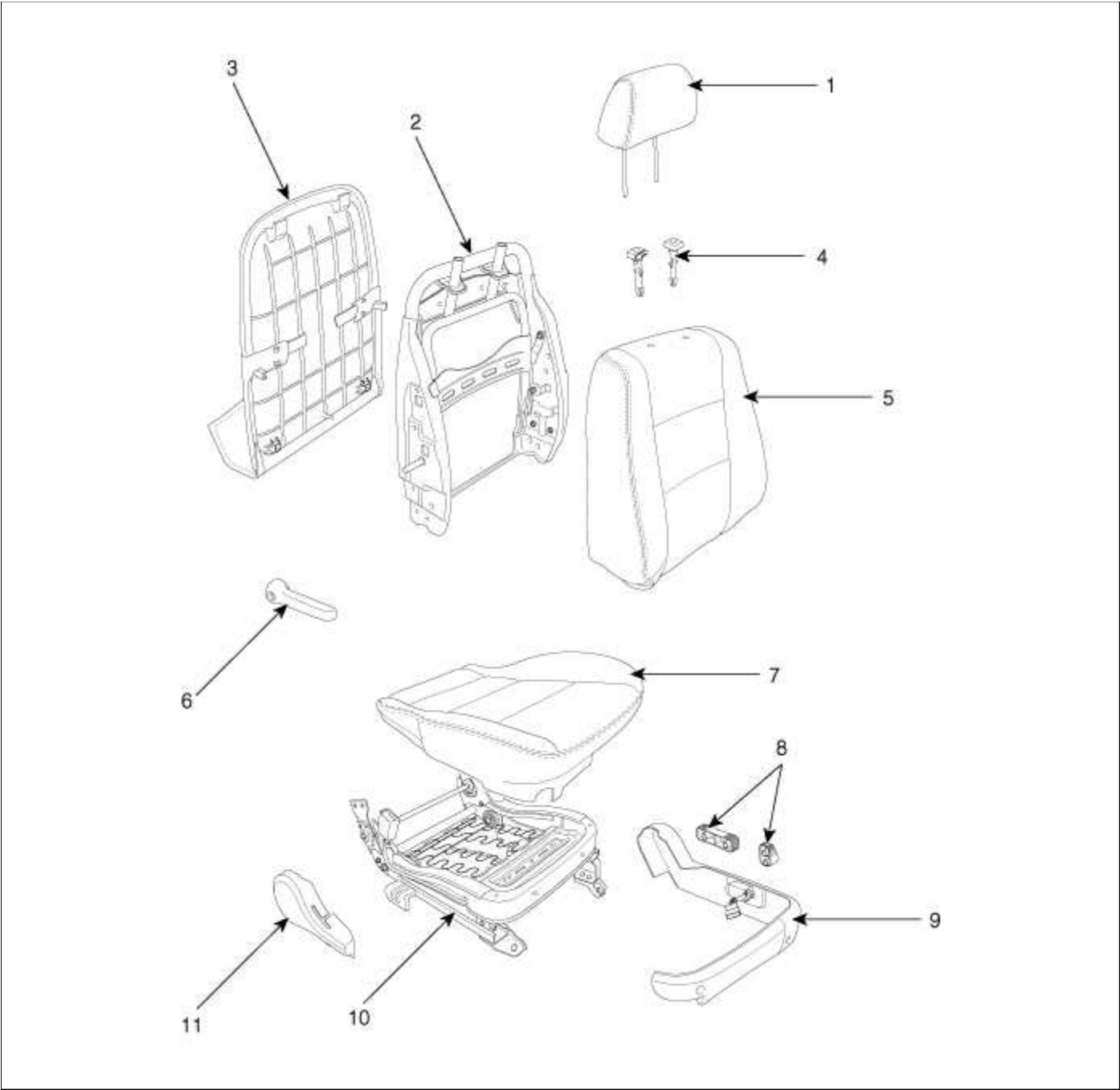
► : Bolt

▷ : Nut



Body (Interior and Exterior) > Seat & Power Seat > front seat > Components and Components Location

COMPONENTS



1. Headrest	7. Seat cushion cover
2. Seat back frame	8. Recliner lever
3. Seat back panel	9. Shield cover
4. Headrest guide	10. Seat cushion frame
5. Seat back cover	11. Recliner cover
6. Lumbar sport lever	

**Body (Interior and Exterior) > Seat & Power Seat > front seat > Repair procedures**

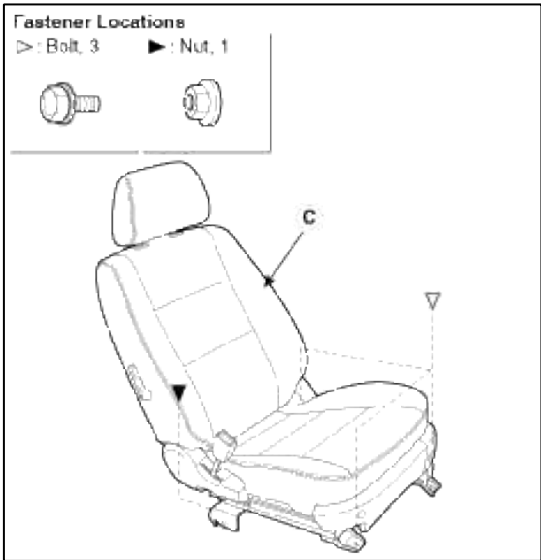
REPLACEMENT

SEAT ASSEMBLY REPLACEMENT

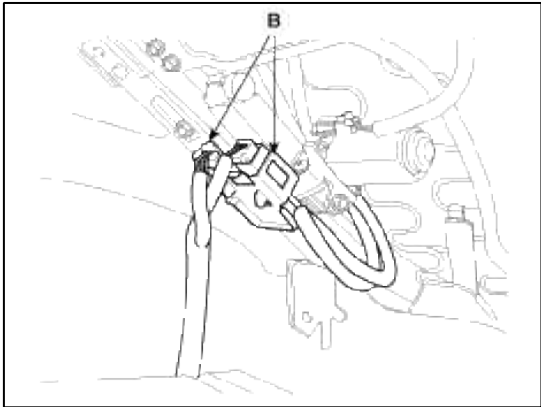
1. Remove the seat assembly mounting cover.



2. After loosening the seat assembly mounting bolts and nuts, remove the seat assembly (C).



3. Disconnect the connector (B).



4. Installation is the reverse of removal.

**CAUTION**

**SEAT MOUNTING BOLT INSTALLATION PROCEDURE**

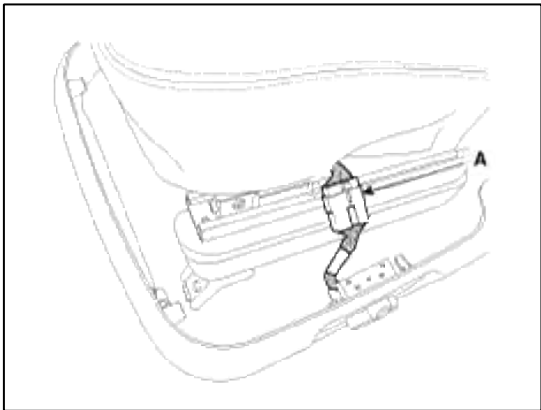
- Set the seat into the most rearward position.  
Make sure each slide is locked, and then tighten the front mounting bolt temporarily.
- Set the seat into most forward position.  
Check that each slide is locked, and then tighten the rear mounting bolt completely.
- Set the seat into the most rearward position.  
Check the front mounting bolt completely.
- Check that the seat operates to and fro smoothly and the locking portion locks properly.

**SEAT BACK COVER REPLACEMENT**

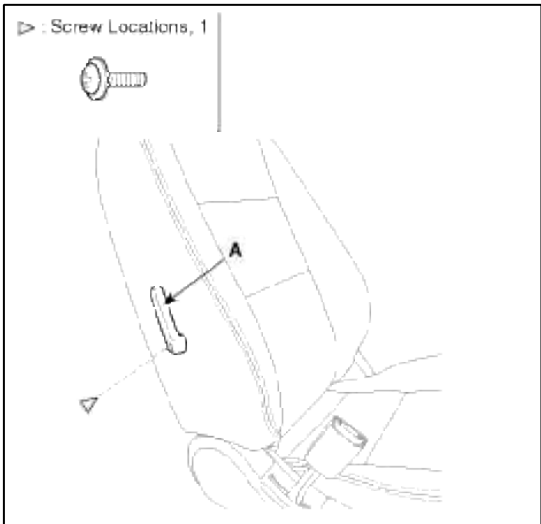
1. Remove front seat assembly.
2. Remove the cover (A).



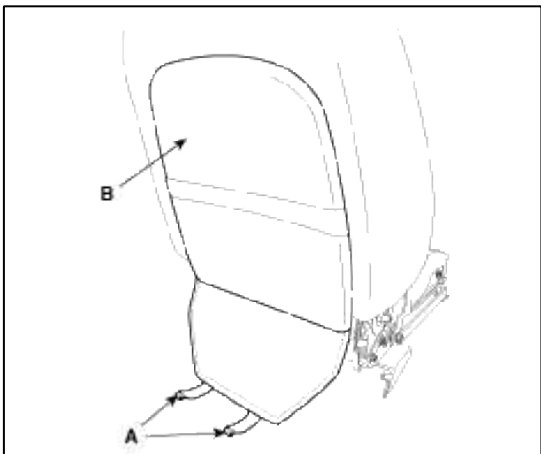
3. Disconnect the protector (A).



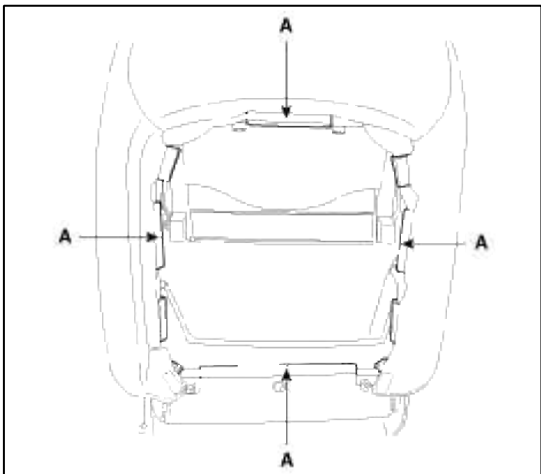
4. Remove the lumbar support lever (A).



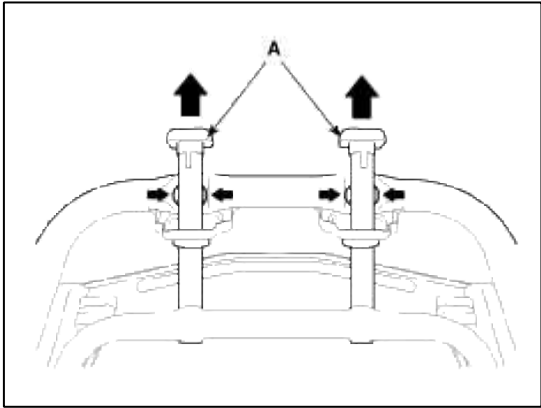
5. After disconnecting the scuff band (A), remove the seat back panel (B).



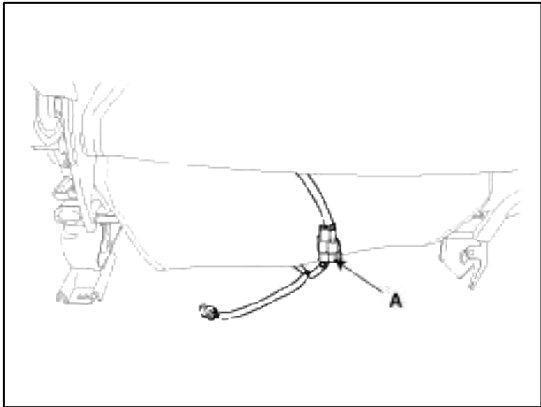
6. Disconnect the protector (A) from the back frame.



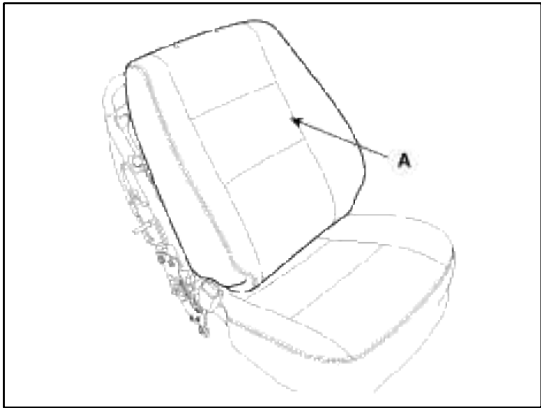
7. Remove the headrest and headrest guide (A).



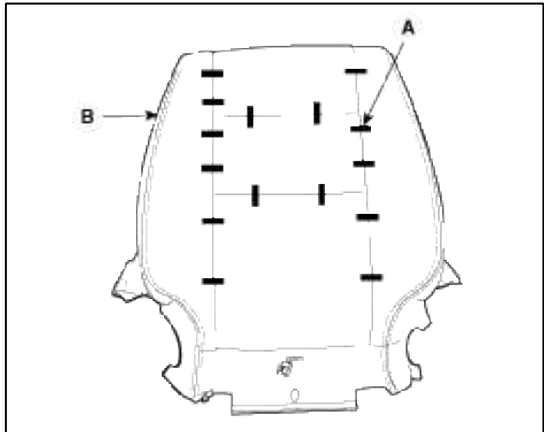
8. Disconnect the connector (A).



9. Remove the seat back cushion (A).



10. After removing the hog-ring clip (A) on the front of seat cushion and remove the seat cushion cover (B).

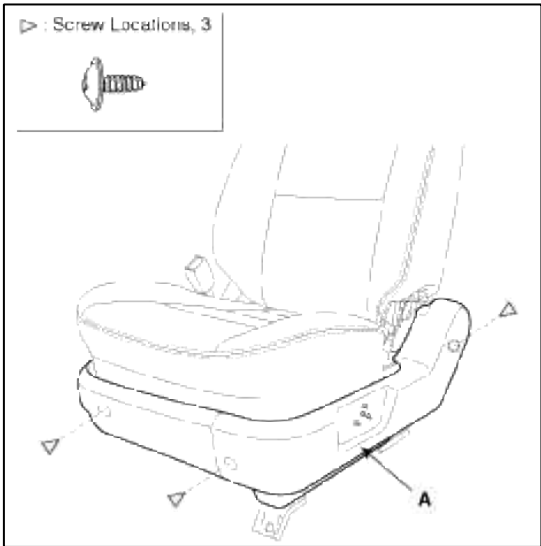


11. Installation is the reverse of removal.

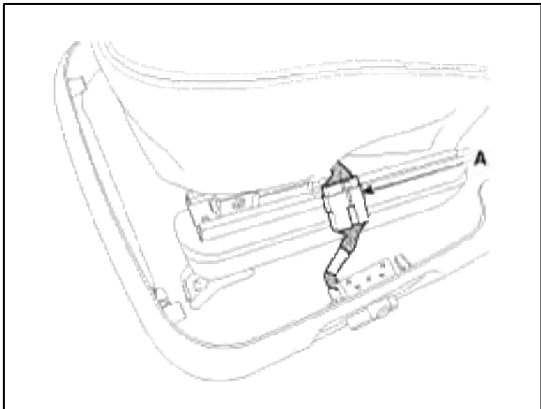
SEAT CUSHION COVER REPLACEMENT

1. Remove front seat assembly.

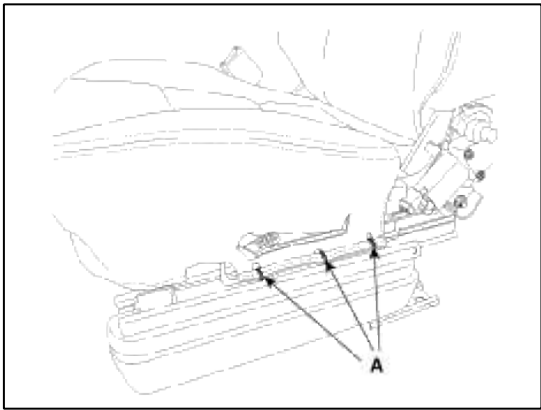
2. Remove the recliner cover (A).



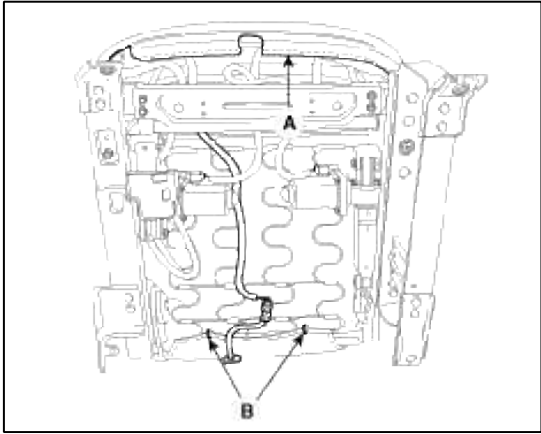
3. Disconnect the connector (A).



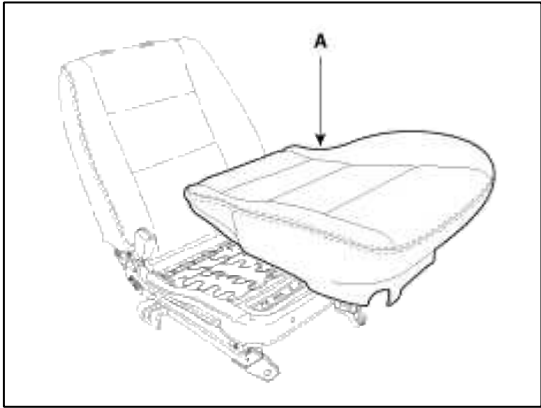
4. Removing the hog-ring clip (A).



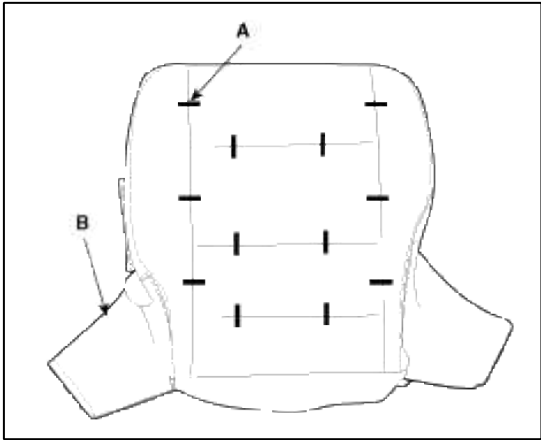
5. Remove the hog-ring clip (B) and bend (A).



6. Remove the seat cushion (A).



7. After removing the hog-ring clip (A) on the front of seat cushion and remove the seat cushion cover (B).



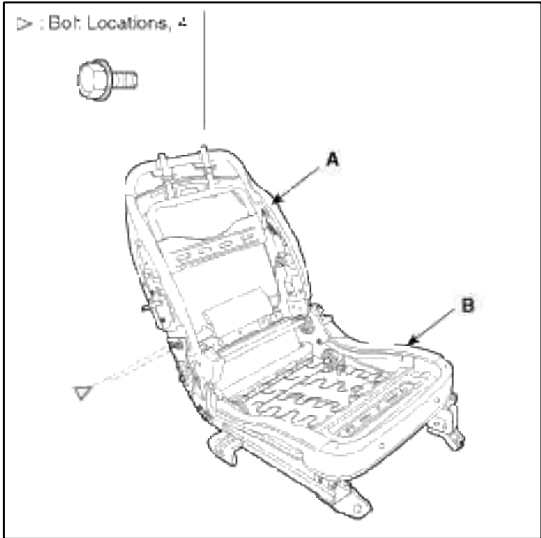
8. Installation is the reverse of removal.

SEAT FRAME REPLACEMENT

1. Remove the following items.

- A. Seat back cushion.
- B. Seat cushion

2. After loosening the mounting bolts, then disconnect the seat back frame (A) and seat cushion frame (B).



3. Installation is the reverse of removal.

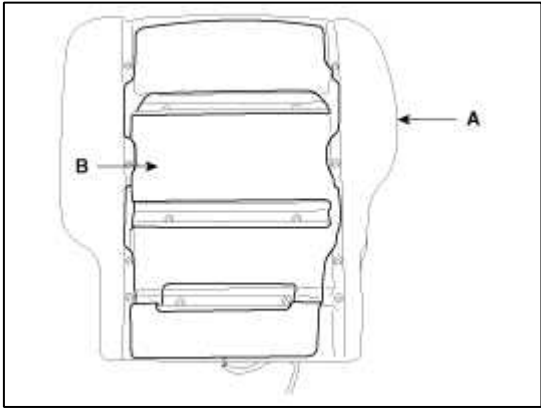
SEAT BACK HEATER REPLACEMENT

1. Remove the seat back cover

2. Remove the seat back pad (A) and heater (B).

NOTE

- Seat back pad and heater is need to changed to new product surely.



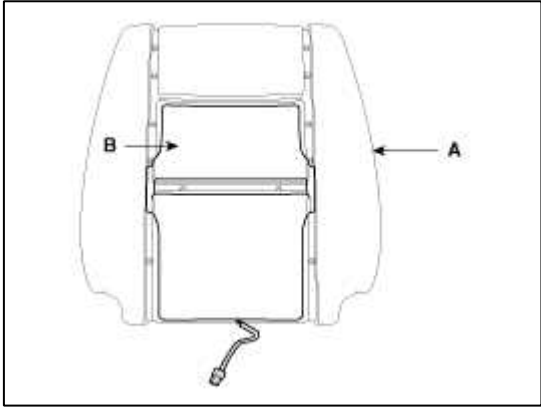
3. Installation is the reverse of removal.

SEAT CUSHION HEATER REPLACEMENT

1. Remove the seat cushion cover.
2. Remove the seat cushion pad (A) and heater (B).

NOTE

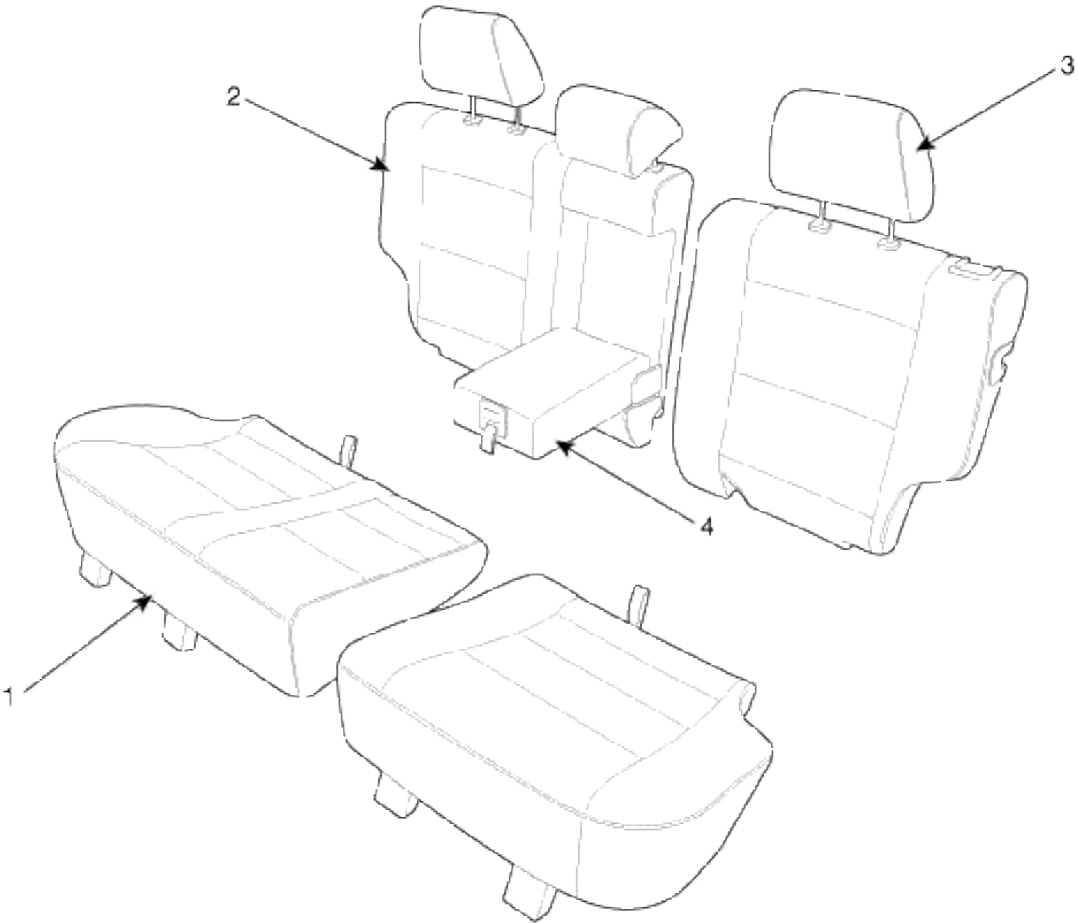
- Seat cushion pad and heater is need to changed to new product surely.



3. Installation is the reverse of removal.

Body (Interior and Exterior) > Seat & Power Seat > rear seat > Components and Components Location

COMPONENTS



1. Seat cushion

2. seat back

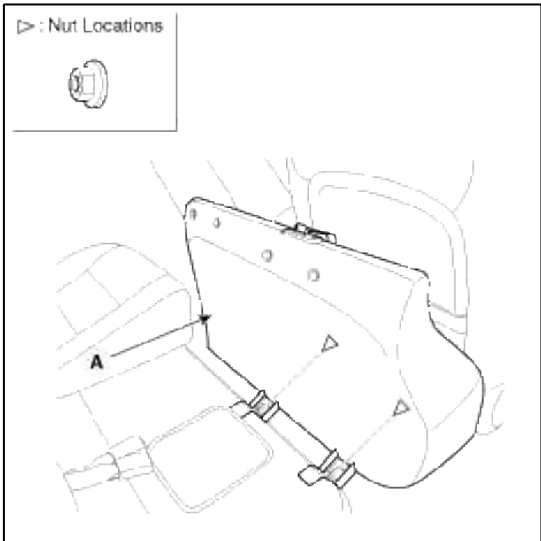
3. Head rest

4. Armrest

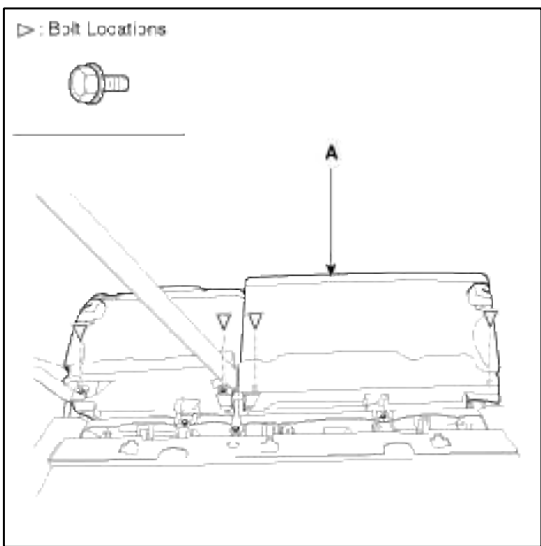
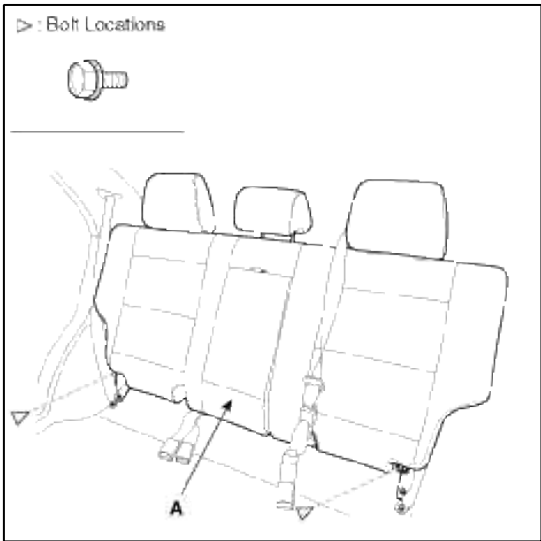
**Body (Interior and Exterior) > Seat & Power Seat > rear seat > Repair procedures**

REPLACEMENT  
SEAT ASSEMBLY REPLACEMENT

1. After loosening the mounting nuts, then remove the seat cushion(A).



2. After loosening the mounting bolts, then remove the seat back(A).

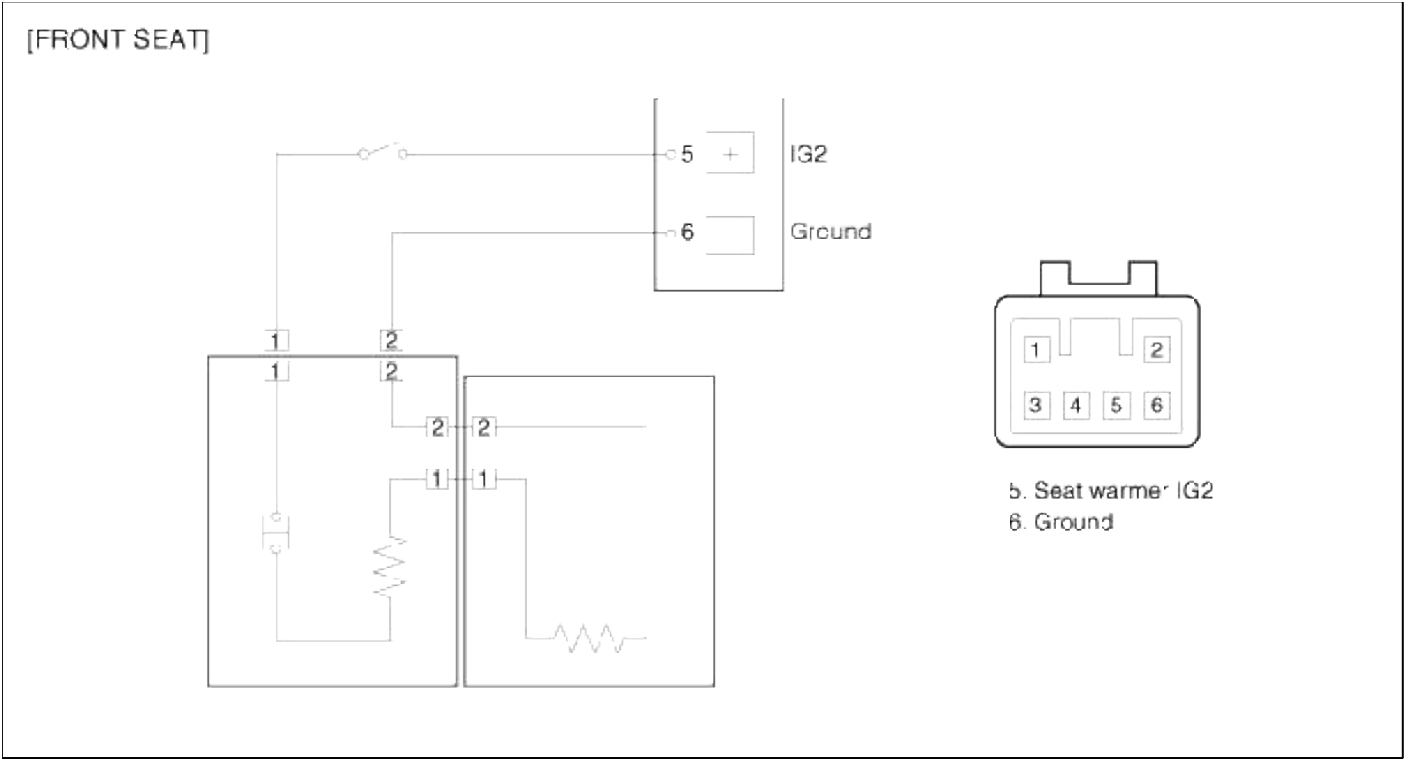


3. Installation is the reverse of removal.

**Body (Interior and Exterior) > Seat Heater > Schematic Diagrams**

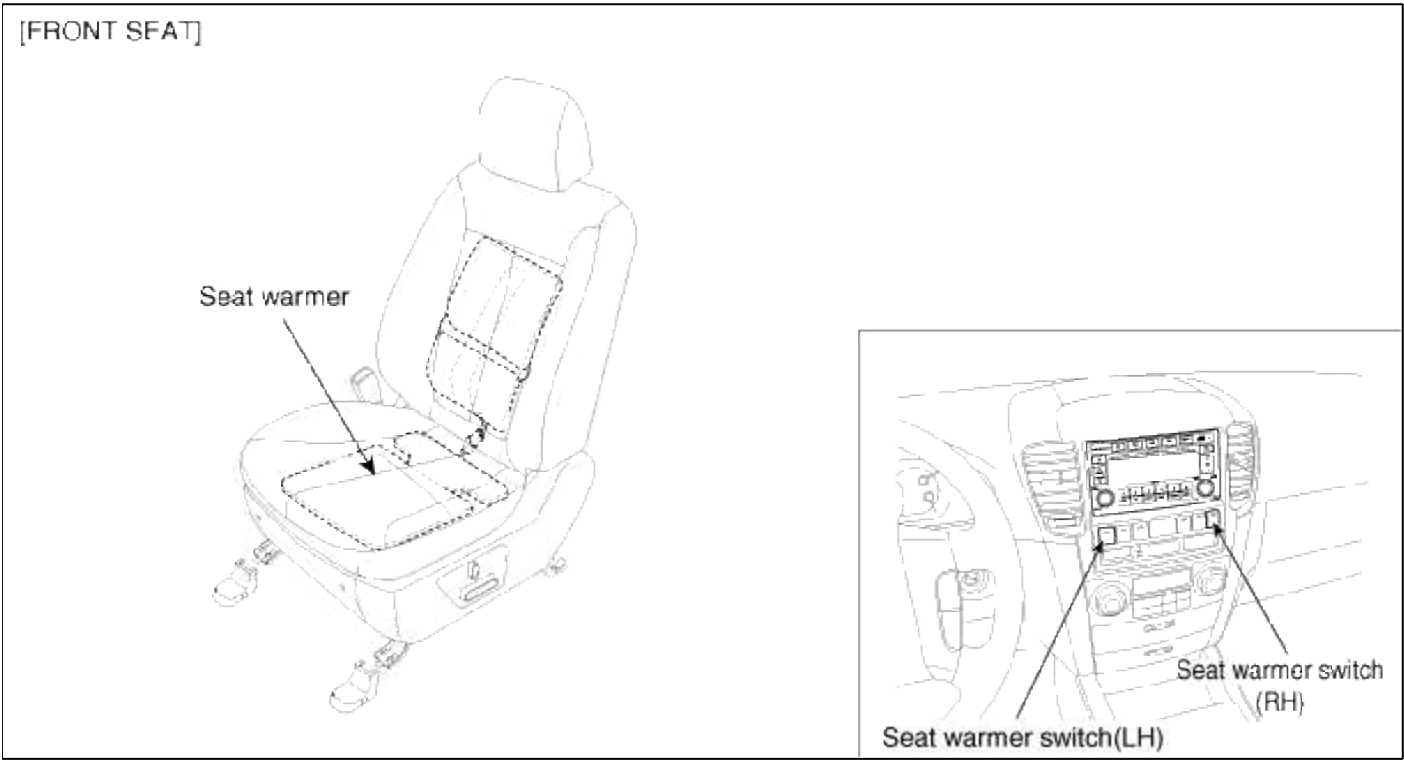
**CIRCUIT DIAGRAM**





**Body (Interior and Exterior) > Seat Heater > Components and Components Location**

COMPONENT LOCATION



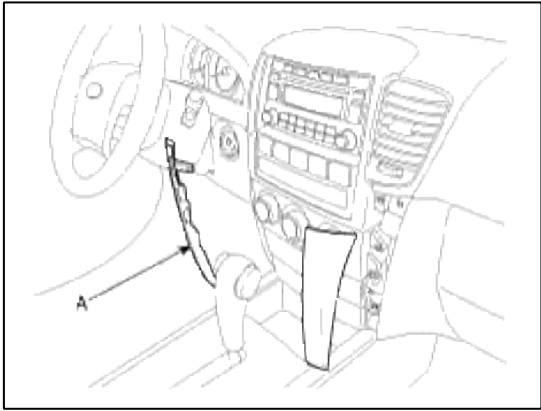
**Body (Interior and Exterior) > Seat Heater > Seat Heater switch > Repair procedures**

INSPECTION

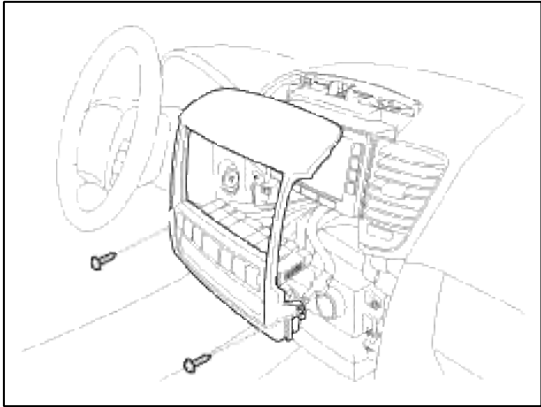
FRONT SEAT WARMER SWITCH

1. Disconnect the negative (-) battery terminal.

2. Remove the side panel (A) after loosening the screws. Avoid damaging retaining clips.



3. Remove the center facia panel.



4. Check for continuity between the terminals in each switch position according to the table.

P T	ON (PUSH)	OFF	REMARK
1			Relay
4			Ground
3			LAMP (+)
6			ILL(+)
2			ILL(-)

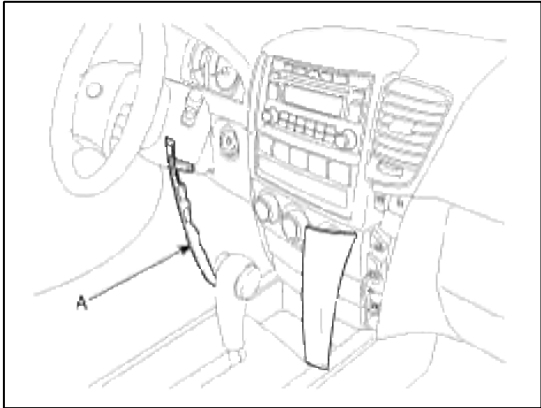
12

3456

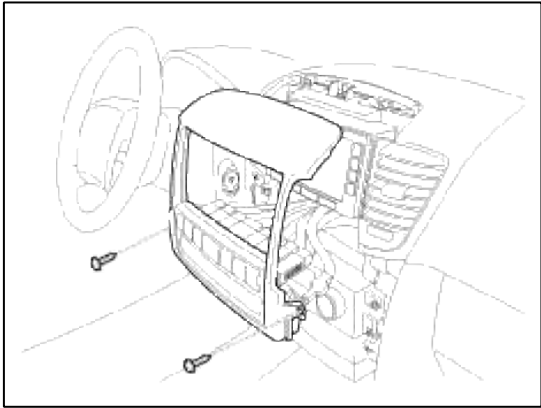
REMOVAL

FRONT SEAT WARMER SWITCH

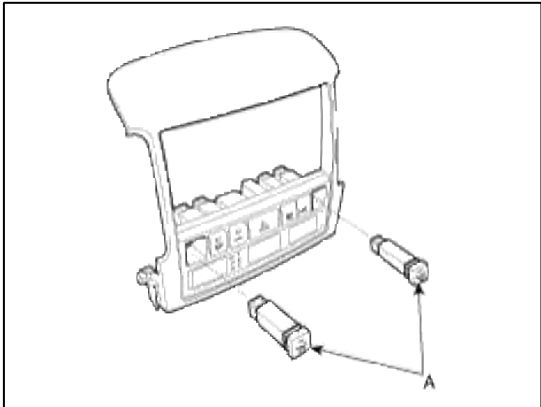
- 1. Disconnect the negative (-) battery terminal
- 2. Remove the side panel (A) after loosening the 2 screws.



3. Remove the front seat heater switch connector from the center facia panel.



4. Remove the front seat heater switch (A).



INSTALLATION

FRONT SEAT WARMER SWITCH

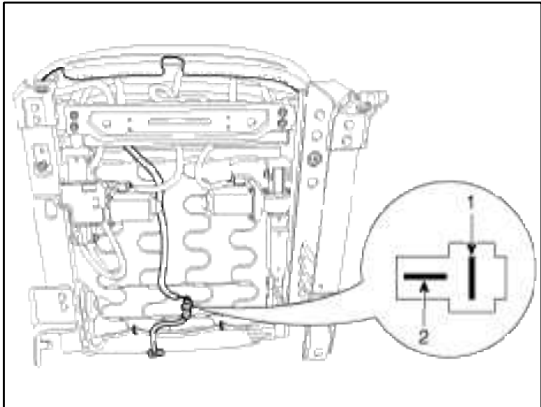
- 1. Reassemble the front seat warmer switch.
- 2. Connect the front seat warmer switch connector to the center facia panel.
- 3. Reassemble the center facia panel.

Body (Interior and Exterior) > Seat Heater > Seat heater > Repair procedures

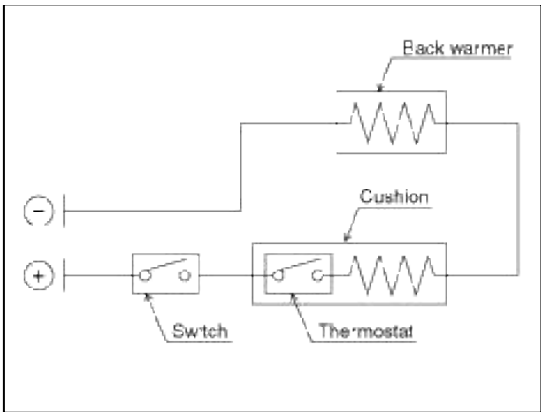
INSPECTION

FRONT SEAT

- 1. Check for continuity and measure the resistance between No.1 and NO.2 terminals.



Standard value:  
LEATHER (Cushion:  $3.04\Omega \pm 10\%$ , Back:  $3.04\Omega \pm 10\%$ )  
CLOTH (Cushion:  $3.04\Omega \pm 10\%$ , Back:  $3.04\Omega \pm 10\%$ )



- 2. Operate the seat warmer after connecting the 2P connector, and then check the thermostat by measuring the temperature of seat surface.
- 3. Check for continuity between the terminals after disconnecting the 2P connector.

Standard value :  
28 ±3.0°C(Continuity), 37 ±3.0°C(Short)

**SORENTO(BL) > 2007 > G 3.3 DOHC > Body Electrical System****Body Electrical System > General Information > Troubleshooting****TROUBLESHOOTING****INSTRUMENTS AND WARNING SYSTEM**

<b>Symptom</b>	<b>Possible cause</b>	<b>Remedy</b>
Tachometer does not operate	Fuse blown Tachometer faulty Wiring faulty	Check for short and replace fuse Check tachometer Repair if necessary
Fuel gauge does not operate	Fuse blown Fuel gauge faulty Fuel sender faulty Wiring faulty	Check for short and replace fuse Check gauge Check fuel sender Repair if necessary
Low fuel warning lamp does not light	Fuse blown Bulb burned out Fuel level sensor faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check sensor Repair if necessary
Water temperature gauge does not operate	Fuse blown Water temperature gauge faulty Water temperature sender faulty Wiring or ground faulty	Check for short and replace fuse Check gauge Check sender Repair if necessary
Oil pressure warning lamp does not light	Fuse blown Bulb burned out Oil pressure sender faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check sender Repair if necessary
Low brake fluid warning lamp does not light	Fuse blown Bulb burned out Brake fluid level warning switch faulty Parking brake switch faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check switch Check switch Repair if necessary
Open door warning lamp does not light	Power connector blown Bulb burned out Door switch faulty Wiring or ground faulty	Check for connection Replace bulb Check switch Repair if necessary
Seat belt warning lamp does not light	Fuse blown Bulb burned out Buckle switch faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check switch Repair if necessary

**LIGHTING SYSTEM**

<b>Symptom</b>	<b>Possible cause</b>	<b>Remedy</b>
One lamp does not light (all exterior)	Bulb burned out Socket, wiring or ground faulty	Replace bulb Repair if necessary
Head lamps do not light	Bulb burned out Fuse blown - Low beam Fuse blown - high beam Head lamp relay faulty Lighting switch faulty Wiring or ground faulty	Replace bulb Check for short and replace fuse Check for short and replace fuse Check relay Check switch Repair if necessary
Tail lamps do not light	Tail lamp fuse blown Fusible link blown Tail lamp relay faulty Lighting switch faulty Wiring or ground faulty	Replace fuse and check for short Replace fusible link Check relay Check switch Repair if necessary
Stop lamps do not light	Fuse blown Stop lamp switch faulty Wiring or ground faulty Stop lamp relay faulty	Replace fuse and check for short Adjust or replace switch Repair if necessary Replace relay
Stop lamps stay on	Stop lamp switch faulty Stop lamp relay faulty	Adjust or replace switch Replace relay
Instrument lamps do not light (Tail lamps light)	Rheostat faulty Wiring or ground faulty	Check rheostat Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out Turn signal switch faulty Wiring or ground faulty	Replace bulb Check switch Repair if necessary
Turn signal lamps do not operate	Fuse blown Flasher faulty Turn signal switch faulty Wiring or ground faulty	Replace fuse and check for short Check flasher Check switch Repair if necessary
Hazard warning lamps do not operate	Fuse blown Flasher faulty Hazard switch faulty Wiring or ground faulty	Replace fuse and check for short Check flasher Check switch Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified Defective flasher	Replace lamps Replace flasher

Back up lamps do not light up	Fuse blown Back up lamp switch faulty Wiring or ground faulty	Replace fuse and check for short Check switch Repair if necessary
Overhead console lamp does not light up	Fuse blown Wiring or ground faulty	Check for short and replace fuse Repair if necessary

## AUDIO

There are six areas where a problem can occur: wiring harness, the radio, the cassette tape deck, the CD player, the speaker, and antenna. Troubleshooting enables you to confine the problem to a particular area.

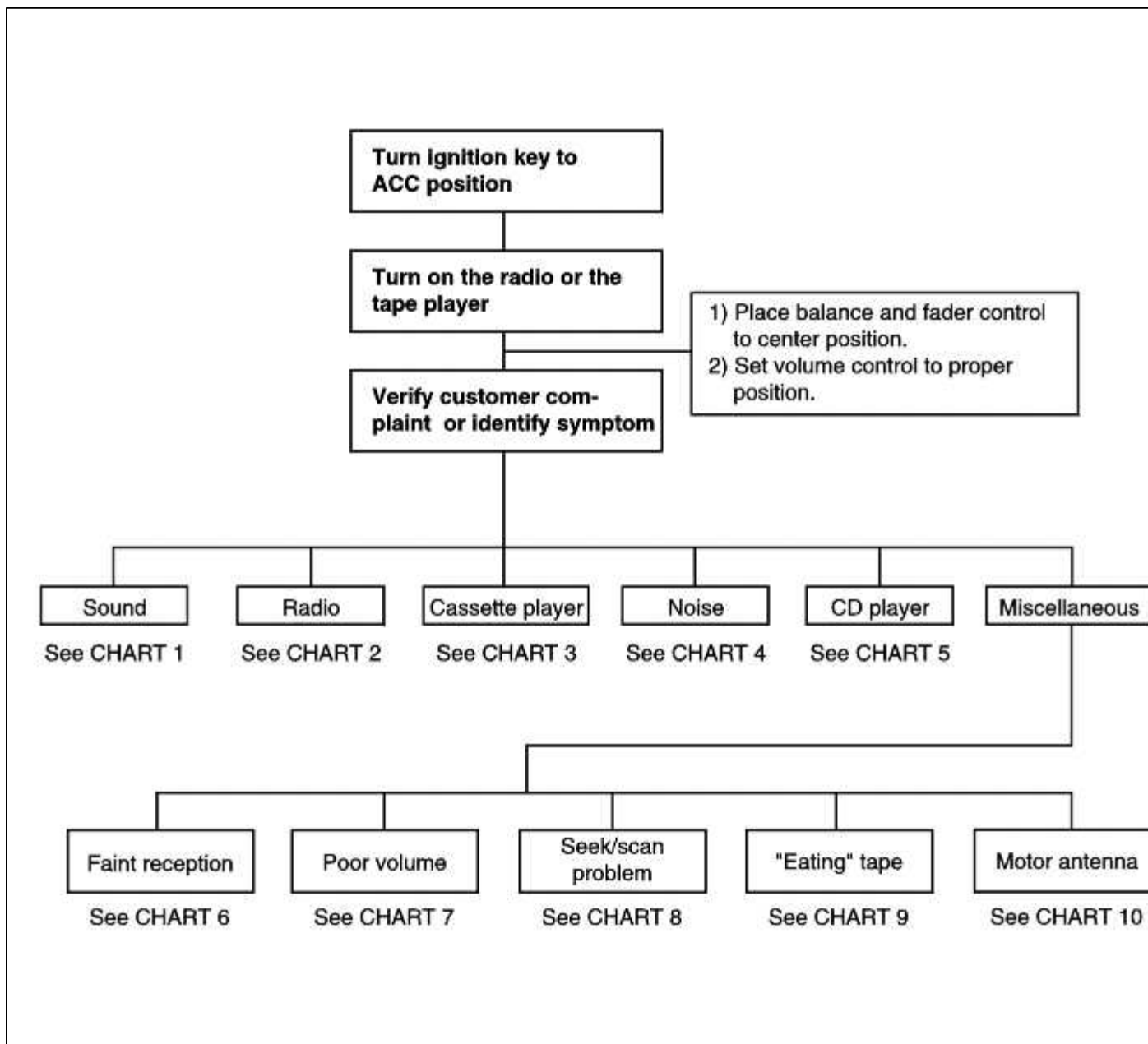
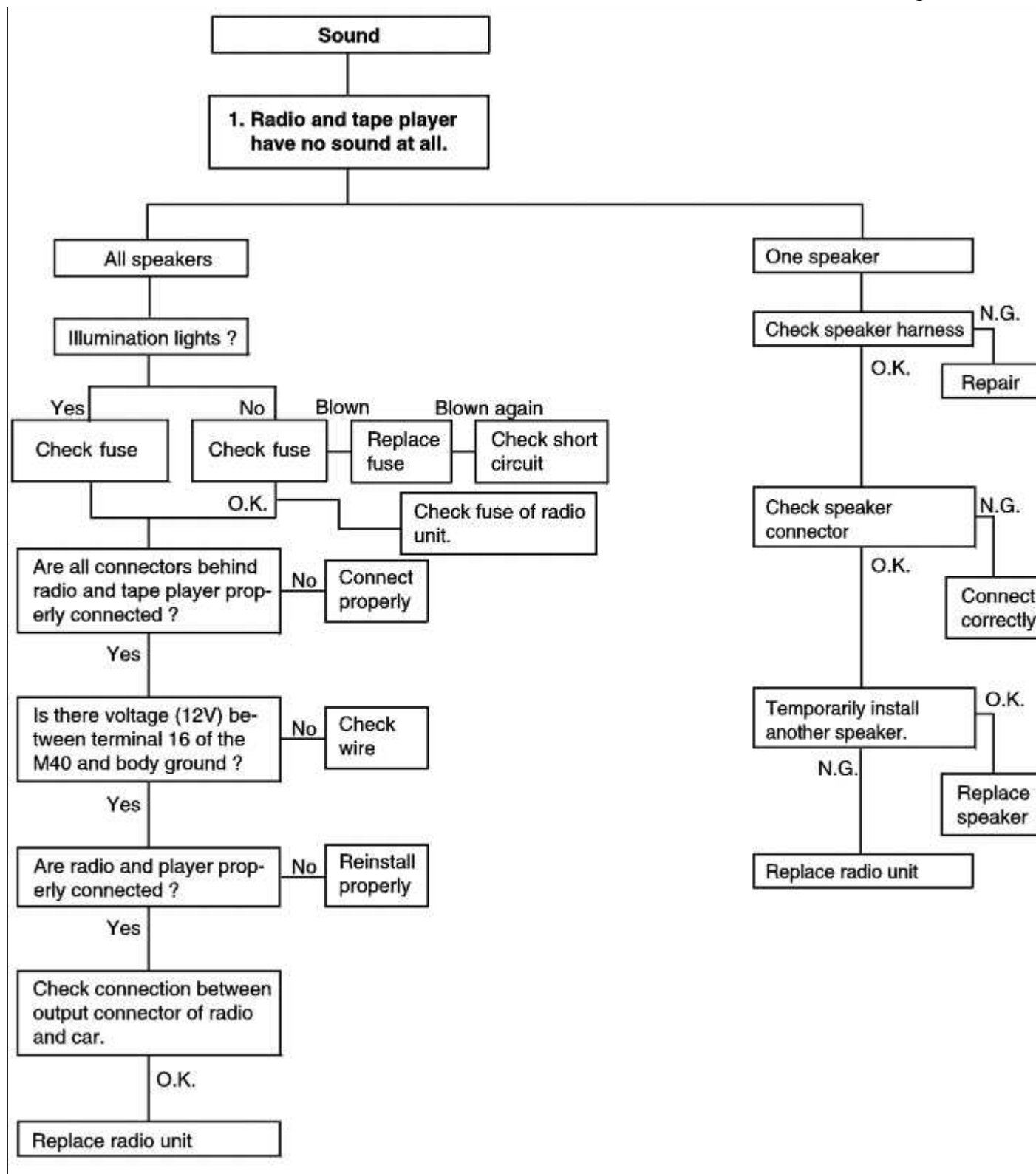


CHART 1





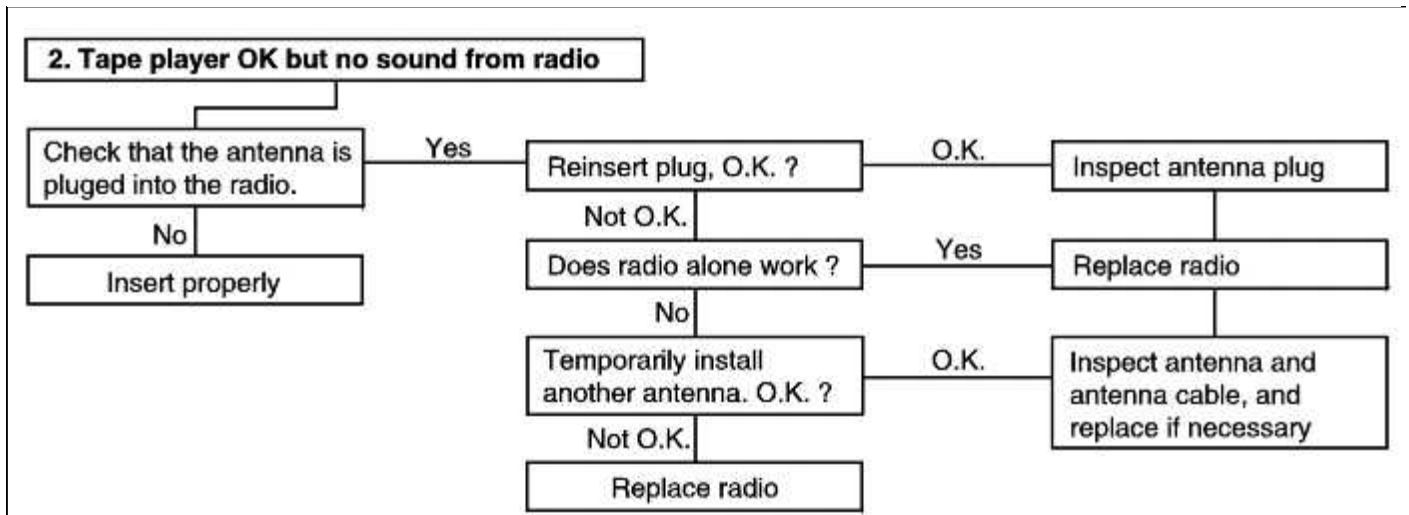


CHART 2

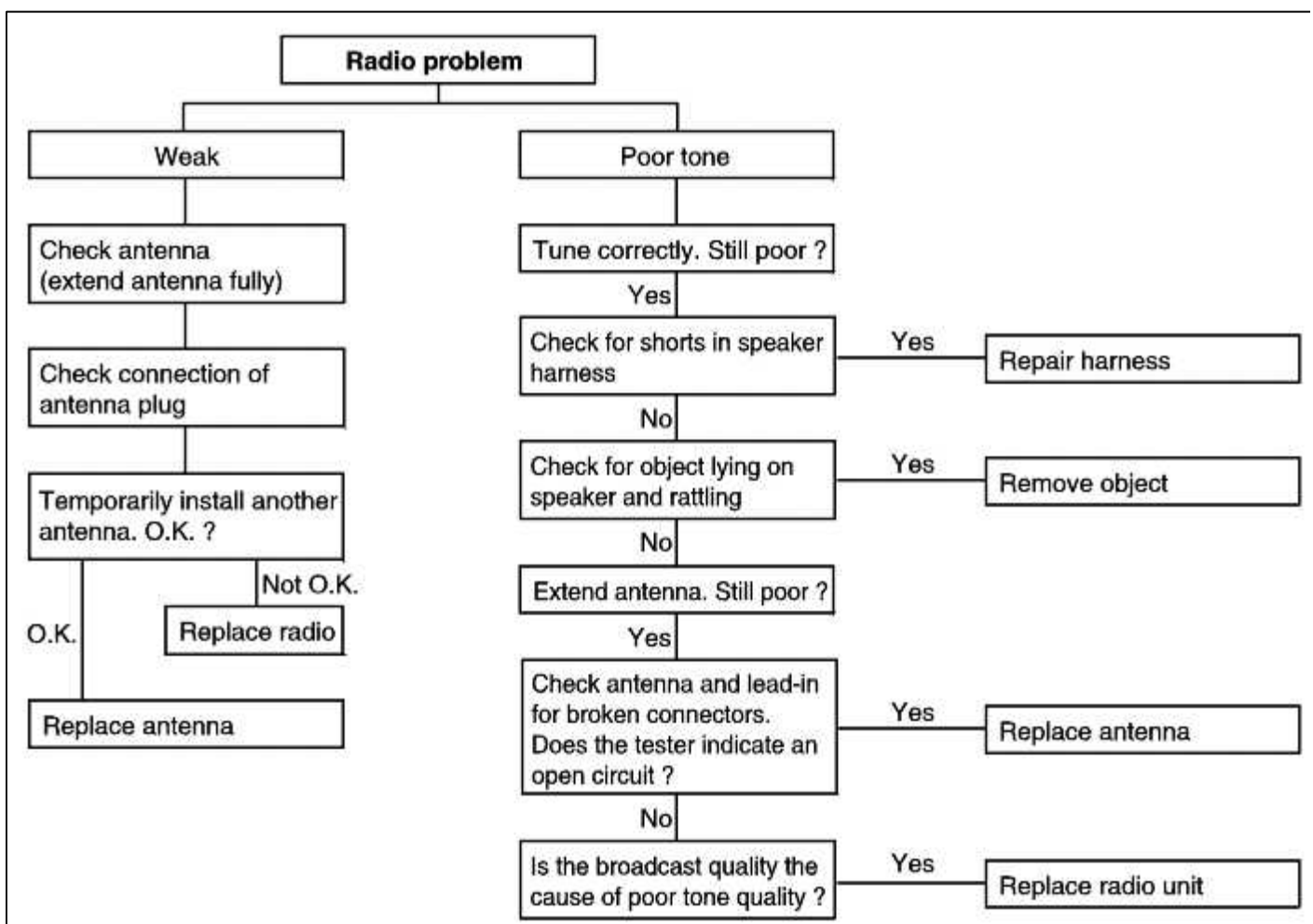


CHART 3

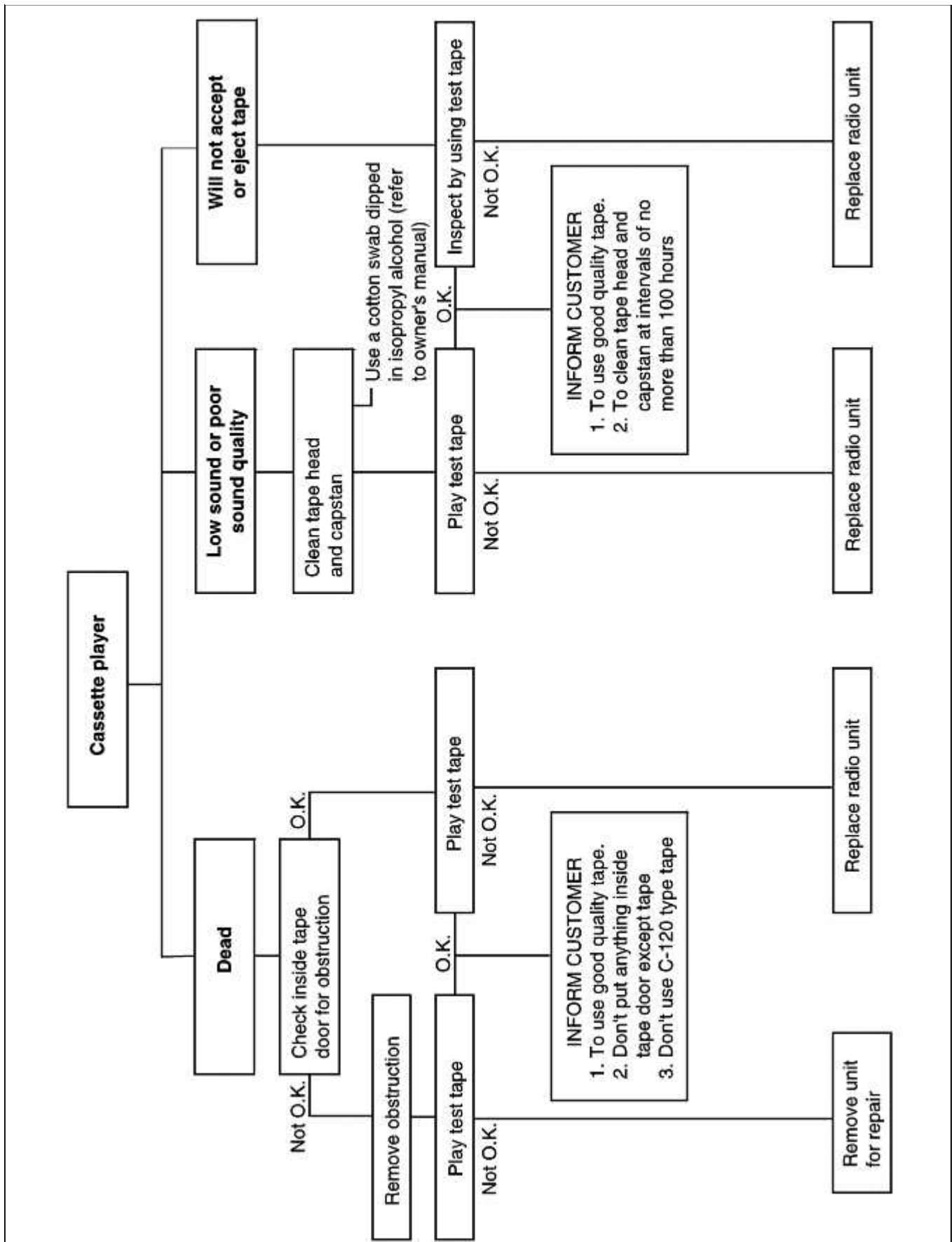
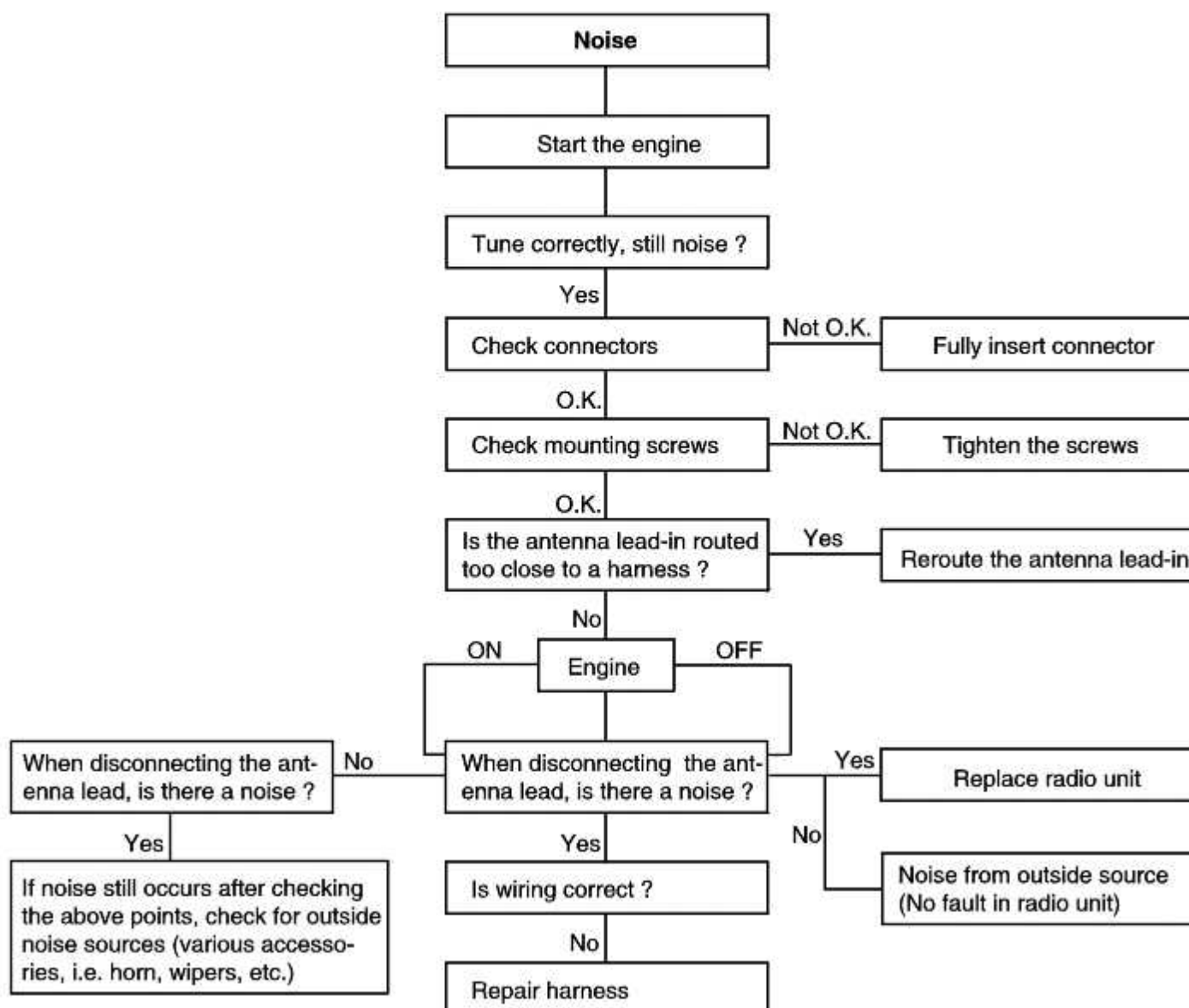
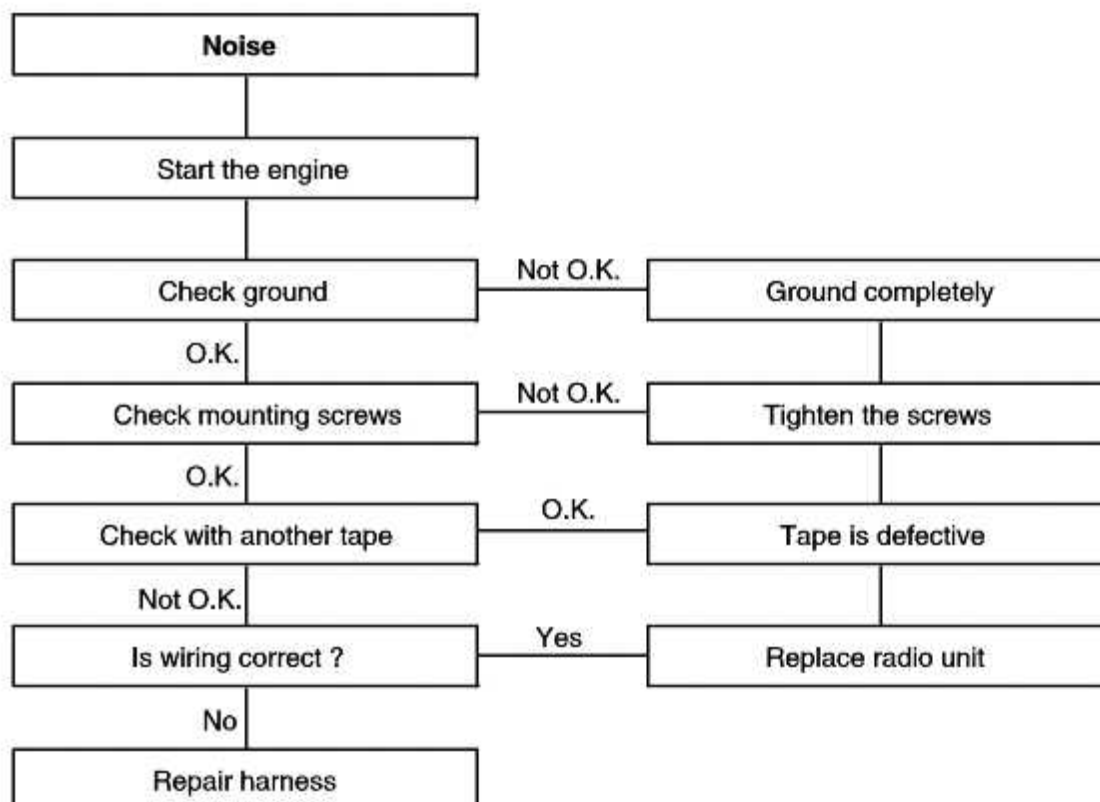


CHART 4

## 1. RADIO

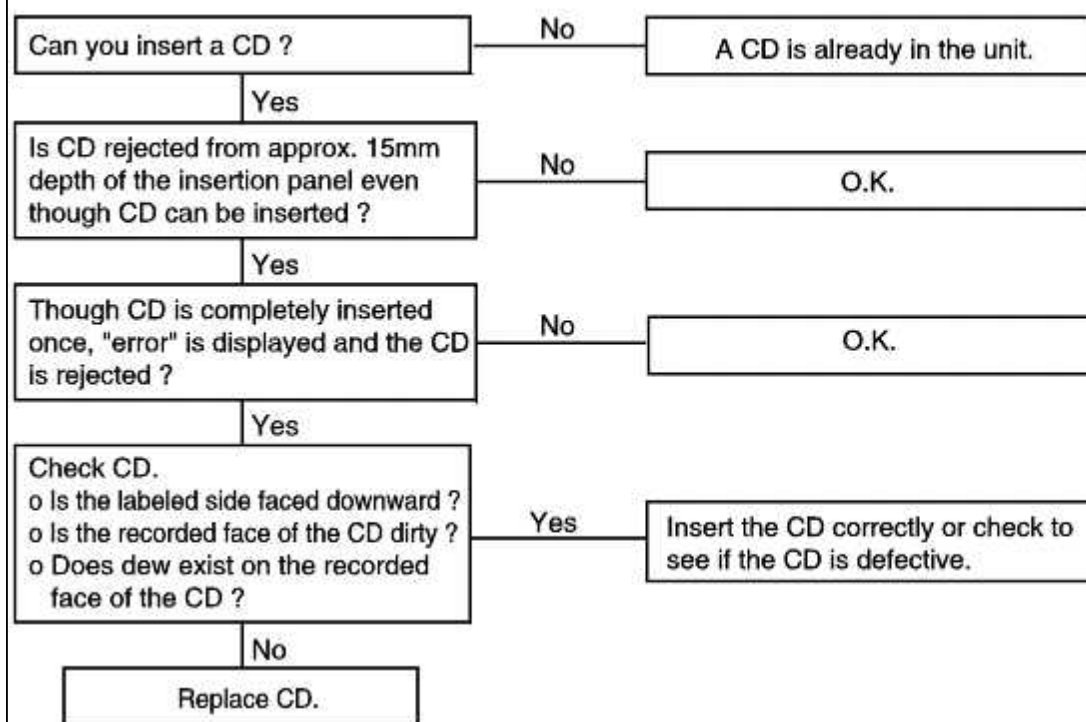


## 2. TAPE

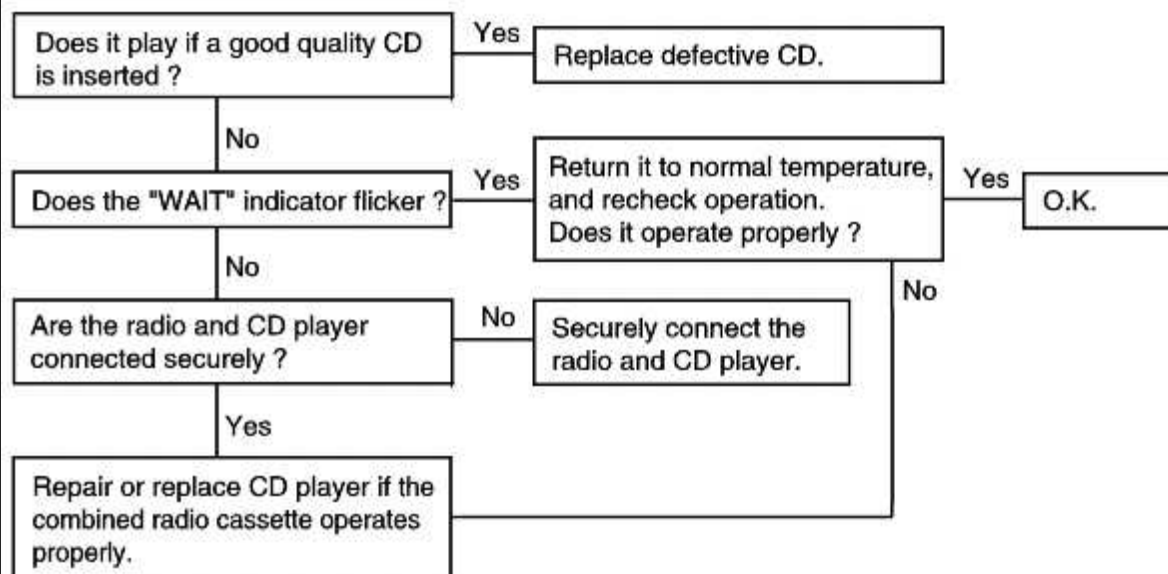


## CHART 5

## 1. CD WILL NOT BE ACCEPTED

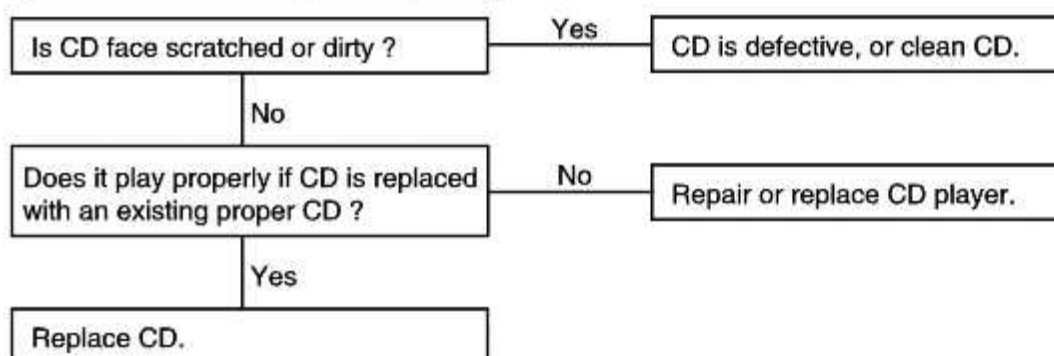


## 2. NO SOUND



## 3. CD SOUND SKIPS

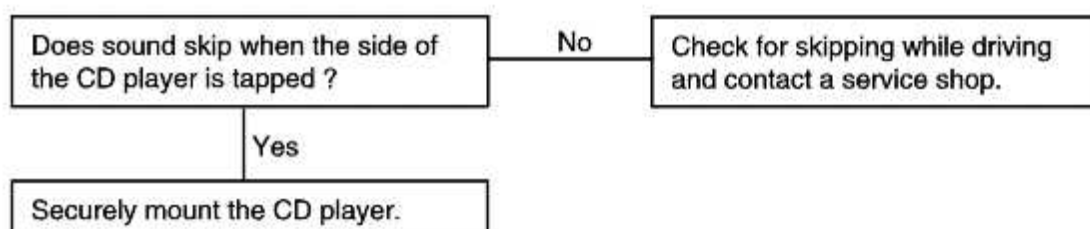
1) Sound sometimes skips when parking.



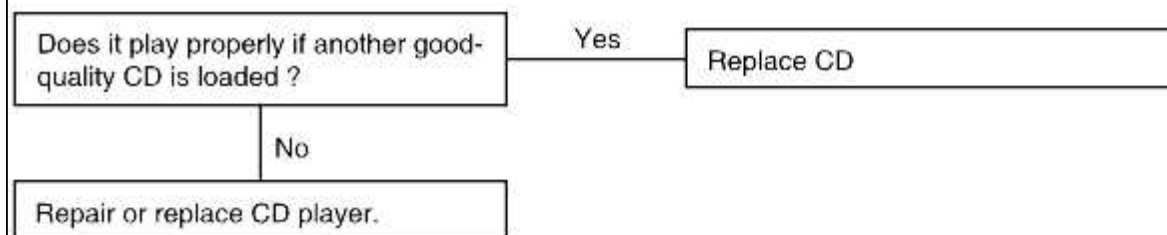
2) Sound sometimes skips when driving.

(Stop vehicle, and check it.)

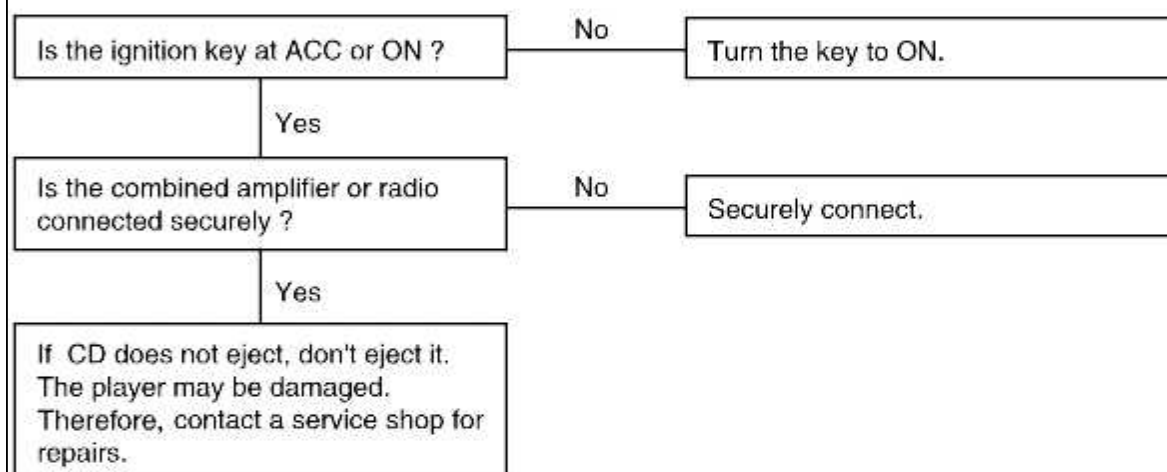
(Check by using a CD which is free of scratches, dirt or other damage.)



## 4. SOUND QUALITY IS POOR



## 5. CD WILL NOT EJECT



## 6. NO SOUND FROM ONE SPEAKER

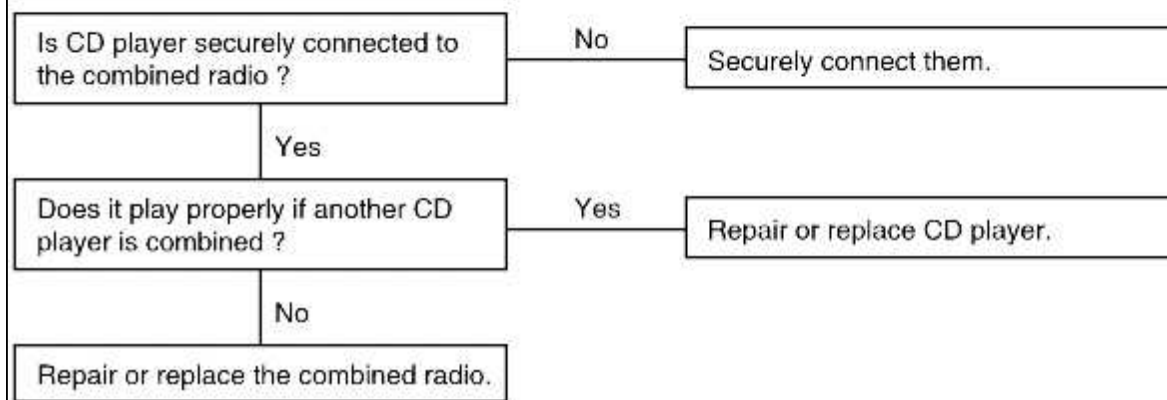


CHART 6

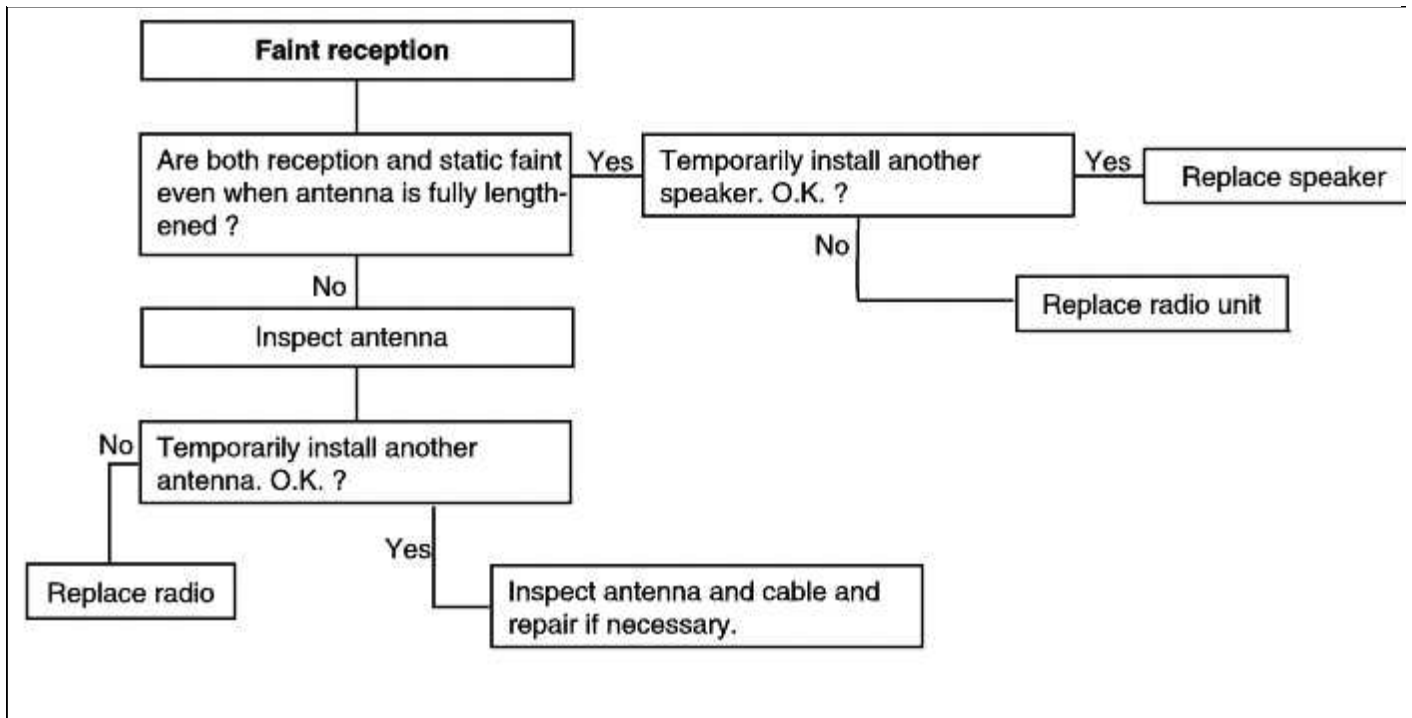


CHART 7

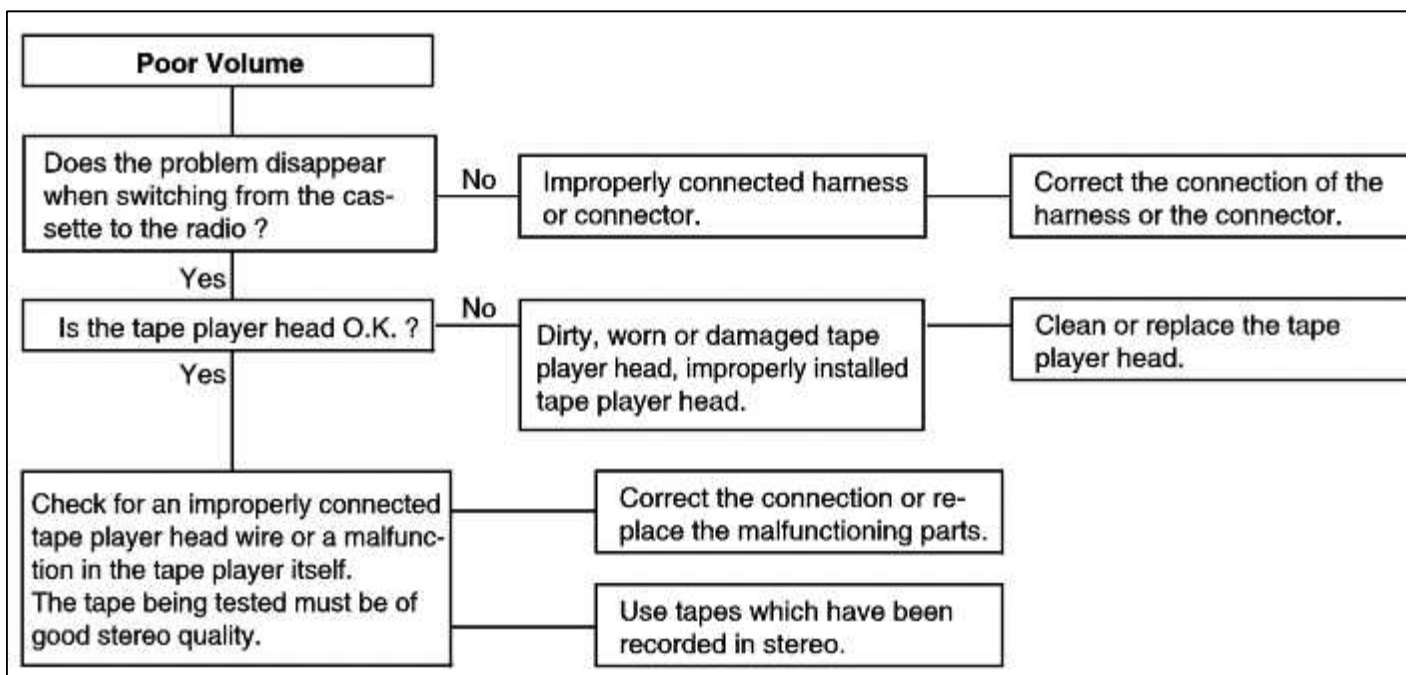


CHART 8

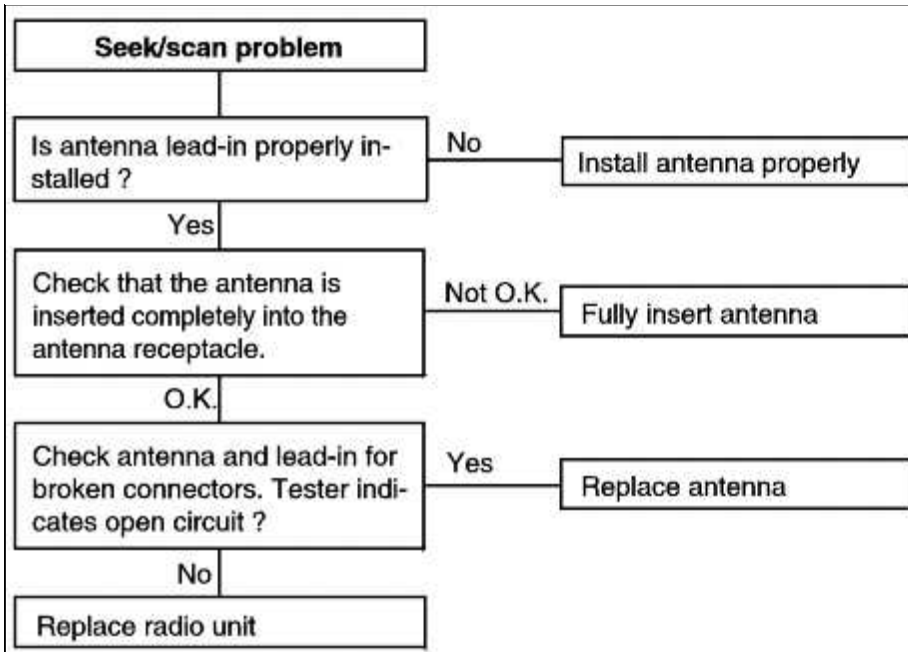


CHART 9

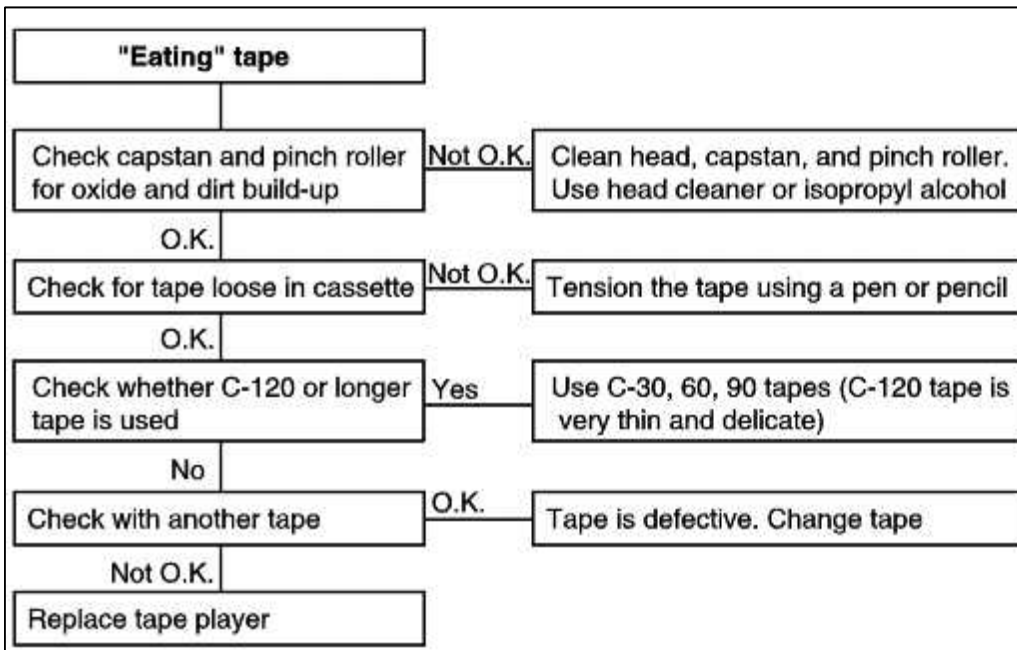
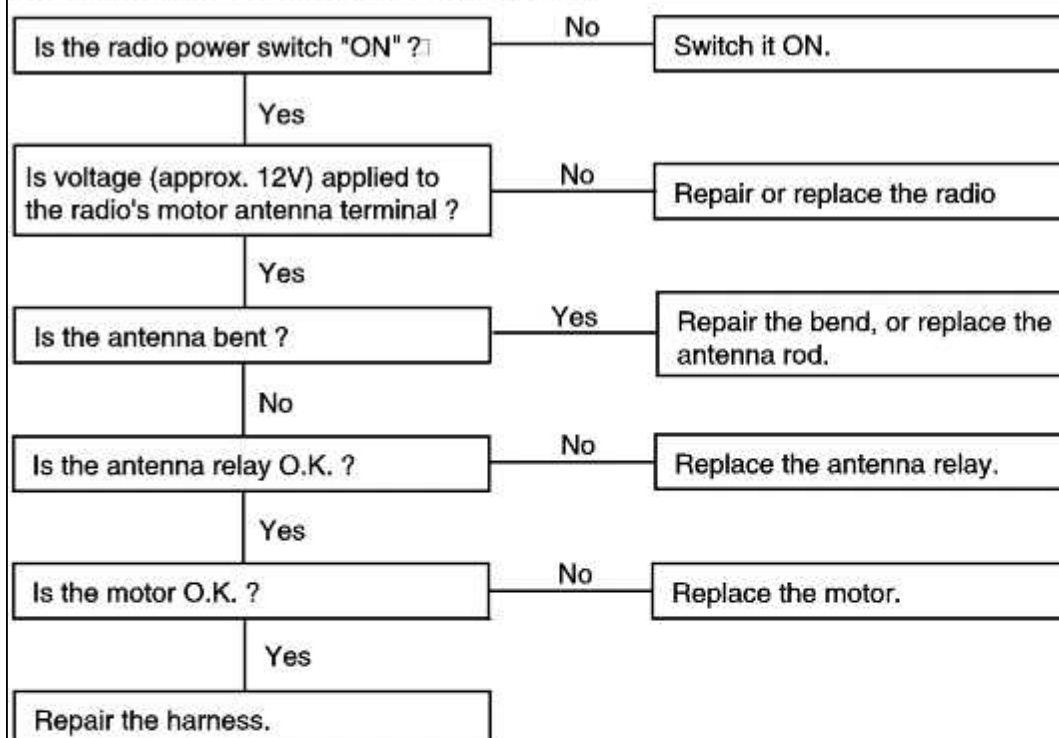
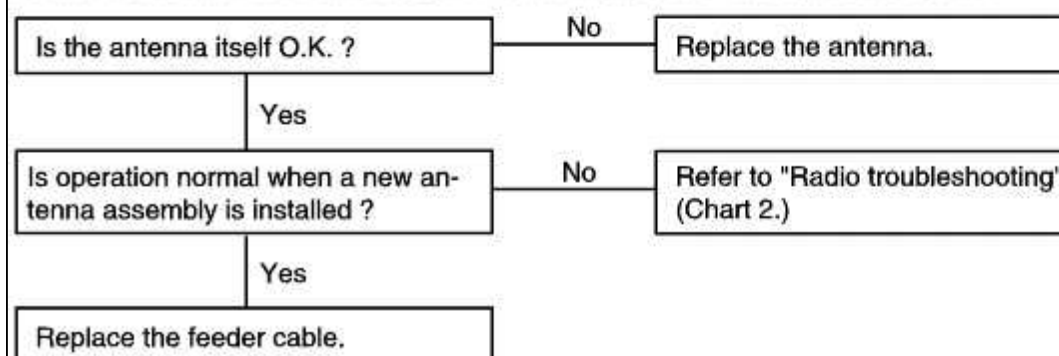


CHART 10



**1. MOTOR ANTENNA WON'T EXTEND OR RETRACT**

Clean and polish the surface of the antenna rod.

**2. MOTOR ANTENNA EXTENDS AND RETRACTS BUT DOES NOT RECEIVE****WINDSHIELD WIPER**

Symptom	Possible cause	Remedy
Wipers do not operate or return to off position.	Wiper fuse blown Wiper motor faulty Wiper switch faulty Wiring or ground faulty	Check for short and replace fuse Check motor Check switch Repair if necessary
Wipers do not operate in INT position	ETACS Module faulty Wiper switch faulty Wiper motor faulty Wiring or ground faulty	Check ETACS Module Check switch Check motor Repair if necessary

**POWER WINDOW**

Symptom	Possible cause	Remedy
No windows operate from the main switch on the driver's door	Fuse blown Poor ground  Defective power window main switch  Open circuit in wires or loose or disconnected connector	Check for short and replace fuse Clean and retighten the ground terminal mounting bolt Check the switch Replace if necessary Repair or replace
Driver's side window does not operate	Defective power window main switch Defective motor or circuit breaker Open circuit in wires or loose or disconnected connector	Check for driver's window switch Replace the motor Check the harness and the connector
Passenger's side window does not operate	Defective power window subswitch Defective motor or circuit breaker Wiring faulty or disconnected connector	Replace the switch Replace the motor Repair if necessary

## POWER DOOR MIRROR

Symptom	Possible cause	Remedy
No mirrors operate	fuse blown Poor ground  Defective mirror switch  Open circuit in wires or loose or disconnected connector	Check the circuit and replace fuse Clean and retighten the ground terminal mounting bolt Check the switch Replace if necessary Repair or replace
One mirror does not operate	Defective mirror switch  Defective mirror actuator Open circuit wires or loose or disconnected connector	Check the switch Replace if necessary Replace the actuator Repair or replace

## Body Electrical System > General Information > Specifications

### SPECIFICATIONS

### MULTIFUNCTION SWITCH

Item	Specifications
Rated Voltage	DC 12V
Operating temperature range	-30°C - +80°C (-22 - +176°F)
Rated load Dimmer & passing switch  Lighting switch Turn signal switch & lane change Front Wiper switch  Front Washer switch Front fog switch Rear wiper Rear washer	High : 1A (Relay load) Low : 1A (Relay load) Passing : 1A (Relay load) Lighting : 1A (Relay load) 6.6 ± 0.5A (Lamp load) Low, Int : 6.0A (Motor load) High : 6.5A (Motor load) Lock : Max. 25A (Motor load) 4 A (Motor load) 1.0 A (Relay load) 1.0 A 4.0 A (Motor load)

## INSTRUMENTS AND WARNING SYSTEM

Illumination	3.0w x 4EA	
Warning lamps	Bulb wattage (w)	Color
Turn signal (LH, RH)	1.4	Green
High beam	1.4	Blue
Sediment	1.4	Red
Rear defroster	1.4	Amber
Back door open	1.4	Red
Door ajar	1.4	Red
O/D OFF	1.4	Amber
Air bag	1.4	Red
Engine check	1.4	Amber
Auto cruise	1.4	Green
Oil pressure	1.4	Red
Parking brake	1.4	Red
Battery charge	1.4	Red
Snow	1.4	Amber
Glow	1.4	Amber
ABS	1.4	Amber
4WD	1.4	Green
Seat belt	1.4	Red
4WD Low	1.4	Green

Washer Low	1.4	Amber
Low fuel	1.4	Amber
A/T		
R	1.4	Red
P, N, D, 2, L	1.4	Green

## SERVICE SPECIFICATIONS INDICATORS AND GAUGES

Items	Specifications																																																																																
Speedometer																																																																																	
Type	<ul style="list-style-type: none"><li>o Coil type</li></ul>																																																																																
Input spec.	<ul style="list-style-type: none"><li>o Hall IC type : 4 pulses/rev.</li></ul>																																																																																
Indication	<ul style="list-style-type: none"><li>o Km/h : 632rpm x 4 pulses/rev. indicates 60Km/h</li><li>o MPH : 1032 rpm x 4 pulses/rev. indicates 60MPH</li></ul>																																																																																
Standard values	<table><tr><td>Velocity (Km/h)</td><td>20</td><td>40</td><td>60</td><td>80</td><td>100</td><td>120</td></tr><tr><td rowspan="2">Tolerance (%)</td><td>+0</td><td>+0</td><td>+0</td><td>+0</td><td>+0</td><td>+0</td></tr><tr><td>-12.6</td><td>-7.3</td><td>-5.9</td><td>-5.2</td><td>-5</td><td>-5</td></tr><tr><td>Velocity (Km/h)</td><td>140</td><td>160</td><td>180</td><td>200</td><td>220</td><td>-</td></tr><tr><td rowspan="2">Tolerance (%)</td><td>+0</td><td>+0</td><td>+0</td><td>+0</td><td>+10</td><td>-</td></tr><tr><td>-5</td><td>-5</td><td>-5</td><td>-5</td><td>-5</td><td>-</td></tr></table> <table><tr><td>Velocity (MPH)</td><td>10</td><td>20</td><td>40</td><td>60</td><td>80</td><td>100</td></tr><tr><td rowspan="2">Tolerance (%)</td><td>+0</td><td>+0</td><td>+0</td><td>+0</td><td>+0</td><td>+0</td></tr><tr><td>-13.6</td><td>-8.8</td><td>-5.7</td><td>-5</td><td>-5</td><td>-5</td></tr><tr><td>Velocity (MPH)</td><td>120</td><td>140</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td rowspan="2">Tolerance (%)</td><td>+0</td><td>+0</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>-5</td><td>-5</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table>	Velocity (Km/h)	20	40	60	80	100	120	Tolerance (%)	+0	+0	+0	+0	+0	+0	-12.6	-7.3	-5.9	-5.2	-5	-5	Velocity (Km/h)	140	160	180	200	220	-	Tolerance (%)	+0	+0	+0	+0	+10	-	-5	-5	-5	-5	-5	-	Velocity (MPH)	10	20	40	60	80	100	Tolerance (%)	+0	+0	+0	+0	+0	+0	-13.6	-8.8	-5.7	-5	-5	-5	Velocity (MPH)	120	140	-	-	-	-	Tolerance (%)	+0	+0	-	-	-	-	-5	-5	-	-	-	-
Velocity (Km/h)	20	40	60	80	100	120																																																																											
Tolerance (%)	+0	+0	+0	+0	+0	+0																																																																											
	-12.6	-7.3	-5.9	-5.2	-5	-5																																																																											
Velocity (Km/h)	140	160	180	200	220	-																																																																											
Tolerance (%)	+0	+0	+0	+0	+10	-																																																																											
	-5	-5	-5	-5	-5	-																																																																											
Velocity (MPH)	10	20	40	60	80	100																																																																											
Tolerance (%)	+0	+0	+0	+0	+0	+0																																																																											
	-13.6	-8.8	-5.7	-5	-5	-5																																																																											
Velocity (MPH)	120	140	-	-	-	-																																																																											
Tolerance (%)	+0	+0	-	-	-	-																																																																											
	-5	-5	-	-	-	-																																																																											
Tachometer	<ul style="list-style-type: none"><li>o Tap the speedometer to prevent hysteresis effects during inspection.</li></ul>																																																																																
Type	<ul style="list-style-type: none"><li>o Cross - coil type ( 3 pulses/rev )</li></ul>																																																																																
Standard values	<table><tr><td>Revolution (RPM)</td><td>1,000</td><td>2,000</td><td>3,000</td><td>4,000</td><td>5,000</td><td>6,000</td><td>7,000</td><td>Remarks</td></tr><tr><td rowspan="2">Tolerance (%)</td><td>+6</td><td>+7.5</td><td>+6</td><td>+6</td><td>+6</td><td>+6</td><td>+6</td><td rowspan="2">Gasoline</td></tr><tr><td>-12</td><td>-1.5</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table>	Revolution (RPM)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	Remarks	Tolerance (%)	+6	+7.5	+6	+6	+6	+6	+6	Gasoline	-12	-1.5	-	-	-	-	-																																																							
Revolution (RPM)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	Remarks																																																																									
Tolerance (%)	+6	+7.5	+6	+6	+6	+6	+6	Gasoline																																																																									
	-12	-1.5	-	-	-	-	-																																																																										
Fuel gauge	<ul style="list-style-type: none"><li>o Tap the tachometer to prevent hysteresis effects during inspection.</li></ul>																																																																																
Type	<ul style="list-style-type: none"><li>o Cross - coil type (Fixed point type : Pointer should not fall into the "E" point but indicate remaining fuel level when the ignition is off)</li></ul>																																																																																
Standard values	<table><tr><th rowspan="2">Level</th><th>Gauge</th><th rowspan="2">Gauge angle (°)</th></tr><tr><th>Resistance (Ω)</th></tr><tr><td>E (Empty)</td><td>97</td><td>-45 ± 2.5</td></tr><tr><td>1/2</td><td>32.5</td><td>0 ±5.0</td></tr><tr><td>F (Full)</td><td>6</td><td>45 ± 2.5</td></tr></table> <ul style="list-style-type: none"><li>o Inspection order : E → F → E The level must be reached within 7 minutes after the resistance is set for Full or Empty.</li><li>o Point stability tolerance : Within 9° Apply power for 10 minutes. Then turn off the power for 30 minutes and read the position of the pointer.</li></ul>	Level	Gauge	Gauge angle (°)	Resistance (Ω)	E (Empty)	97	-45 ± 2.5	1/2	32.5	0 ±5.0	F (Full)	6	45 ± 2.5																																																																			
Level	Gauge		Gauge angle (°)																																																																														
	Resistance (Ω)																																																																																
E (Empty)	97	-45 ± 2.5																																																																															
1/2	32.5	0 ±5.0																																																																															
F (Full)	6	45 ± 2.5																																																																															

Items	Specifications				
Temperature gauge Type Indication standard	o Cross - coil type (Zero return type).				
	Temperature		Angle (°)		
	122°F (50°C)		-30		
	181.4°F ~ 221°F (83°C - 105°C)		-10 ~ 10		
	over 257°F (over 125°C)		30		
Resistance of temperature sender (NTC)	o Inspection order : OFF → C → H				
	Temperature [°F(°C)]	122 (50)	181.4 (83)	221 (105)	257 (125)
	Resistance (Ω)	180.5	48.7	26.7	15.9

## LIGHTING SYSTEM

Items	Bulb wattage(W)
Head lamp	55W / 55W (High / Low)
Front turn signal lamp	28W / 8W
Front position lamp	5W
Front fog lamp	27W
Rear combination lamps	8W / 27W
Tail/stop lamp	
Back up lamp	
Turn signal lamp	
Side marker	
Side repeater lamp	5W
License plate lamp	5W
Sun visor illumi.lamp	5W
Room lamp (Center / Cargo)	10W
Over head lamp	10W
Courtesy lamp	5W
High mount stop lamp	5W

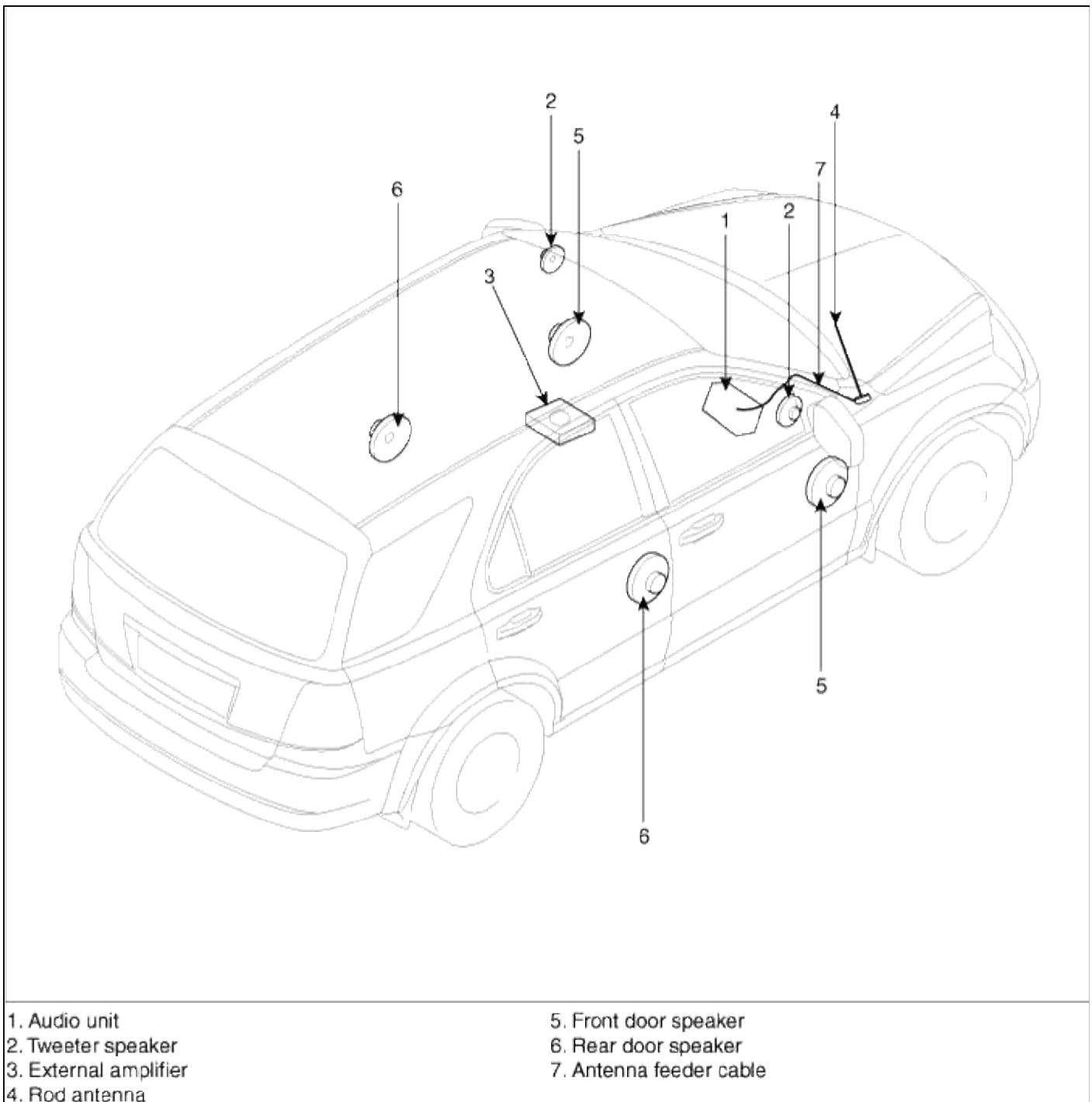
## AUDIO

Items	Specification
Rated output	Max. 41W x 4
Speaker impedance	4ΩX4
Band	AM/FM
Tuning type	PLL Synthesized type
Dark current	Max. 2mA

Items	Specification
Frequency range / Channel	AM : 530~1710KHZ/10KHZ
	FM : 87.9~107.9MHZ/200KHZ

### Body Electrical System > Audio > Components and Components Location

#### COMPONENT LOCATION



### Body Electrical System > Audio > Troubleshooting

## TROUBLESHOOTING

## CUSTOMER COMPLAINT ANALYSIS CHECK SHEET

<b>TROUBLE IN</b>	<input type="checkbox"/> ALL <input type="checkbox"/> AM <input type="checkbox"/> FM <input type="checkbox"/> TAPE <input type="checkbox"/> CD <input type="checkbox"/> MP3 <input type="checkbox"/> CD changer <input type="checkbox"/> AMP <input type="checkbox"/> Others
<b>TROUBLE OCCURS</b>	<input type="checkbox"/> Always <input type="checkbox"/> Engine start <input type="checkbox"/> Engine Running <input type="checkbox"/> Cold <input type="checkbox"/> Warm <input type="checkbox"/> Sometimes <input type="checkbox"/> Most of the time <input type="checkbox"/> Engine off
<b>TYPE OF TROUBLE</b>	<input type="checkbox"/> Will not play <input type="checkbox"/> Tape speed not proper <input type="checkbox"/> Weak <input type="checkbox"/> Squealing noise <input type="checkbox"/> Eats tape <input type="checkbox"/> Display/illumination poor <input type="checkbox"/> CD skips & jumps <input type="checkbox"/> Tape/CD will not eject or insert <input type="checkbox"/> Others (Describe) :
<b>OTHERS</b>	<p>▶ Customer complaint contents :</p> <p>▶ Have you checked customer's defects :</p>
<p>★ Using the customer complaint analysis check sheet for reference, ask the customer for as much detail as possible about the problem.</p>	

There are six areas where a problem can occur: wiring harness, the radio, the cassette tape deck, the CD player, and speaker. Troubleshooting enables you to confine the problem to a particular area.

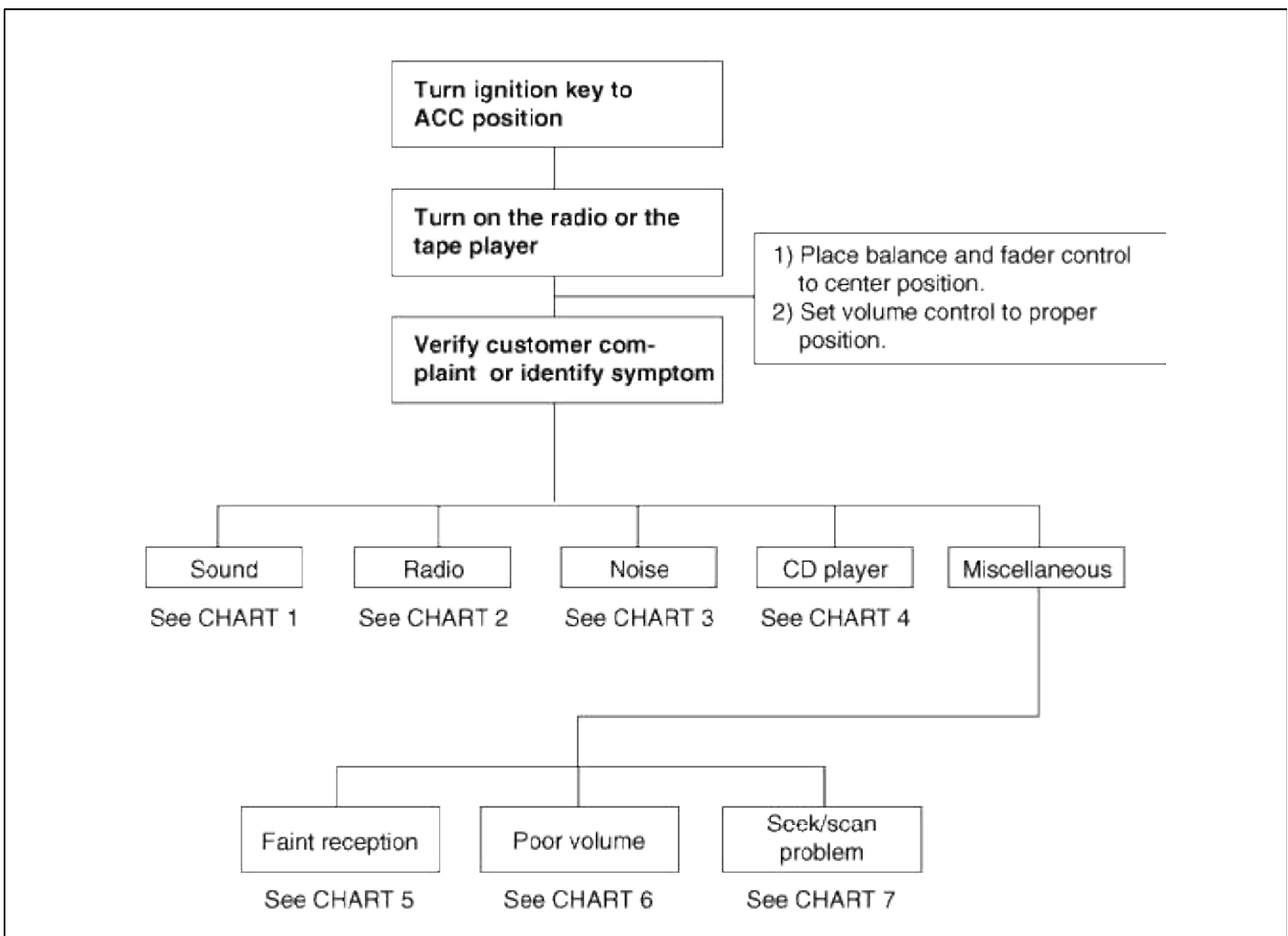
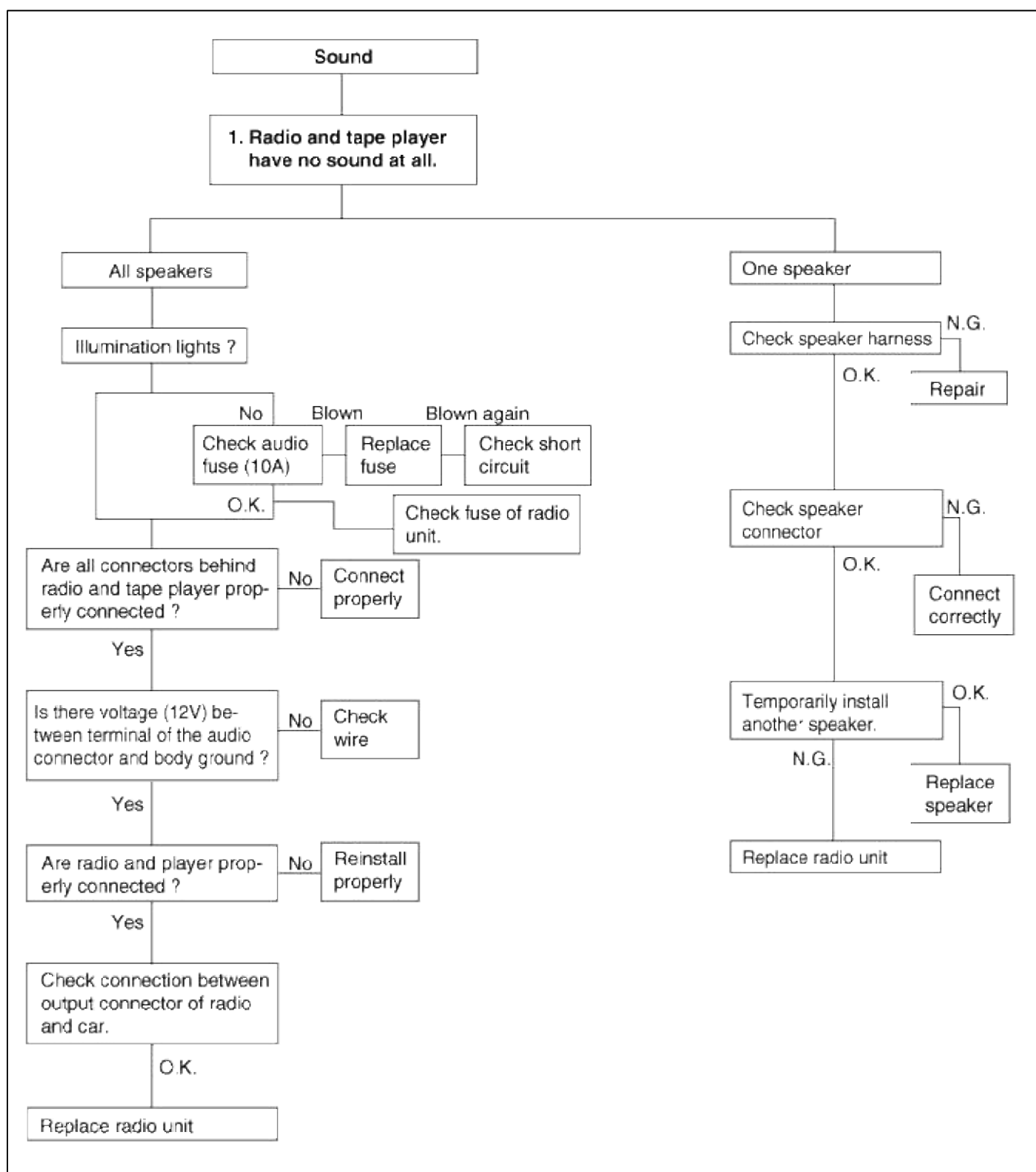




Chart 1



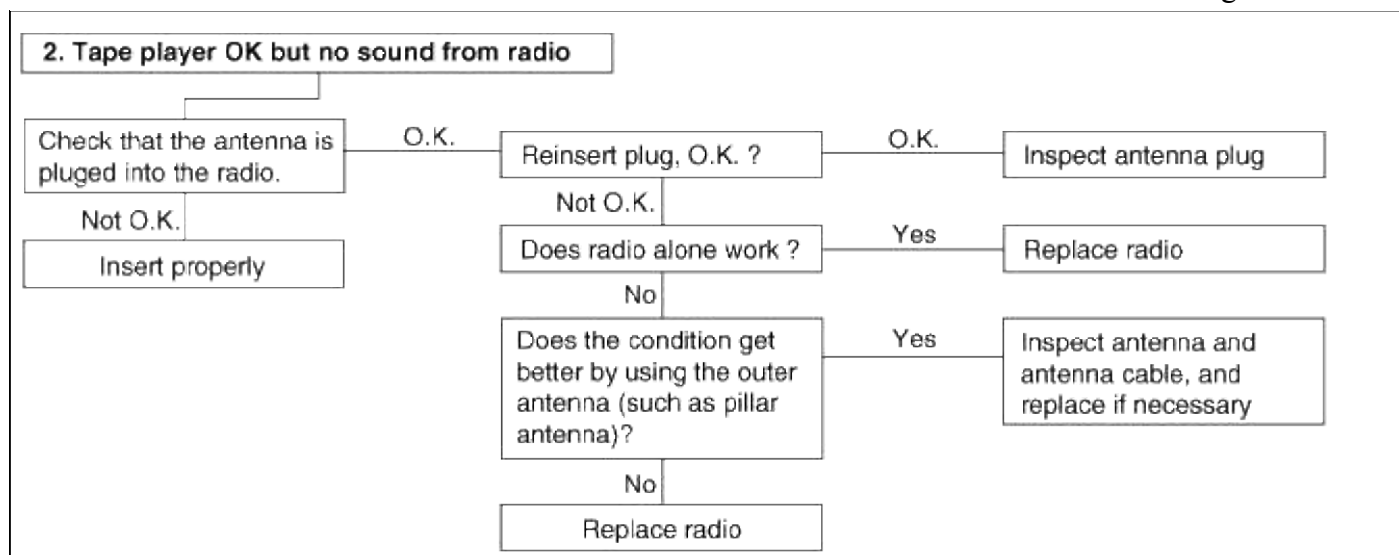


Chart 2

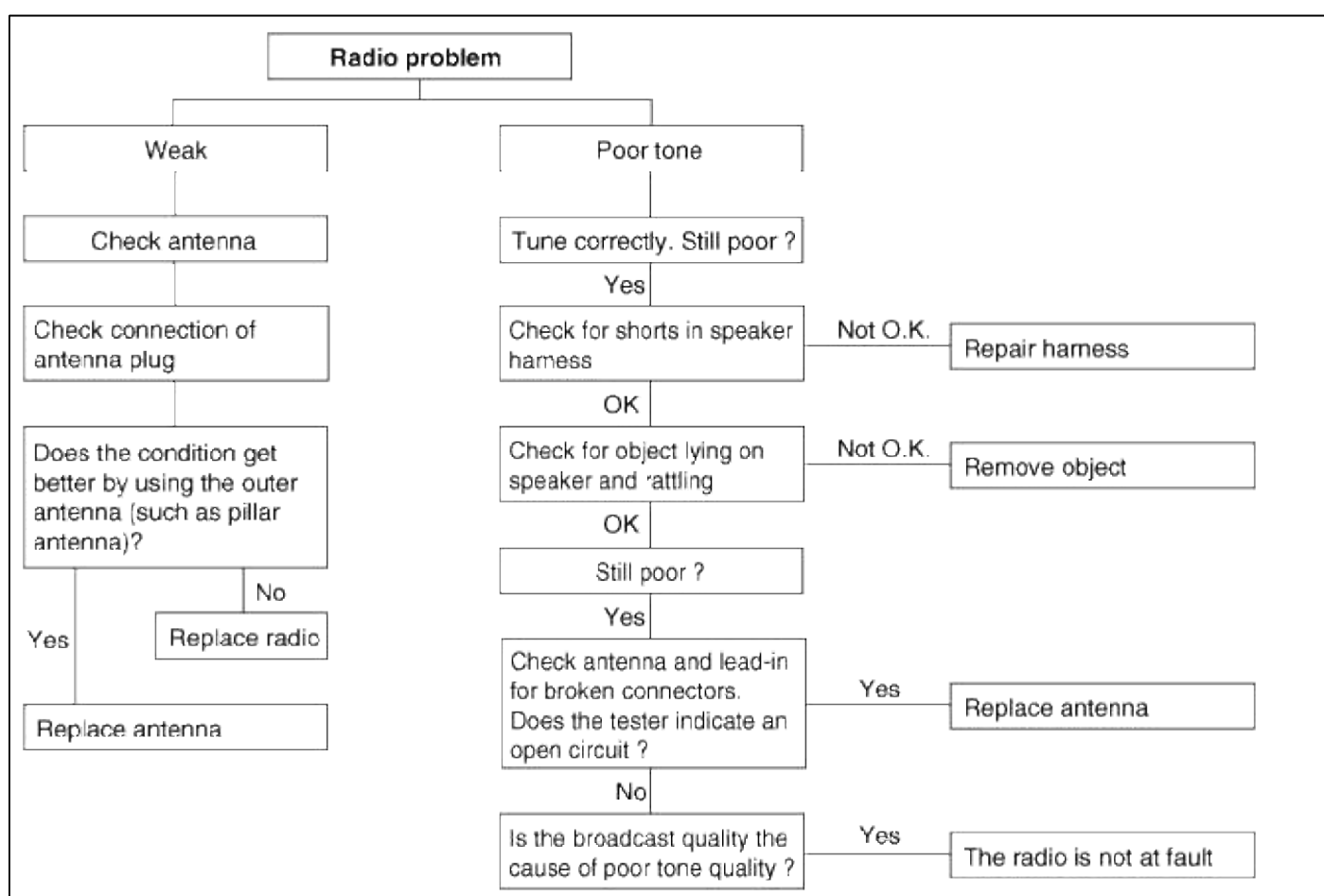


Chart 3

## 1. RADIO

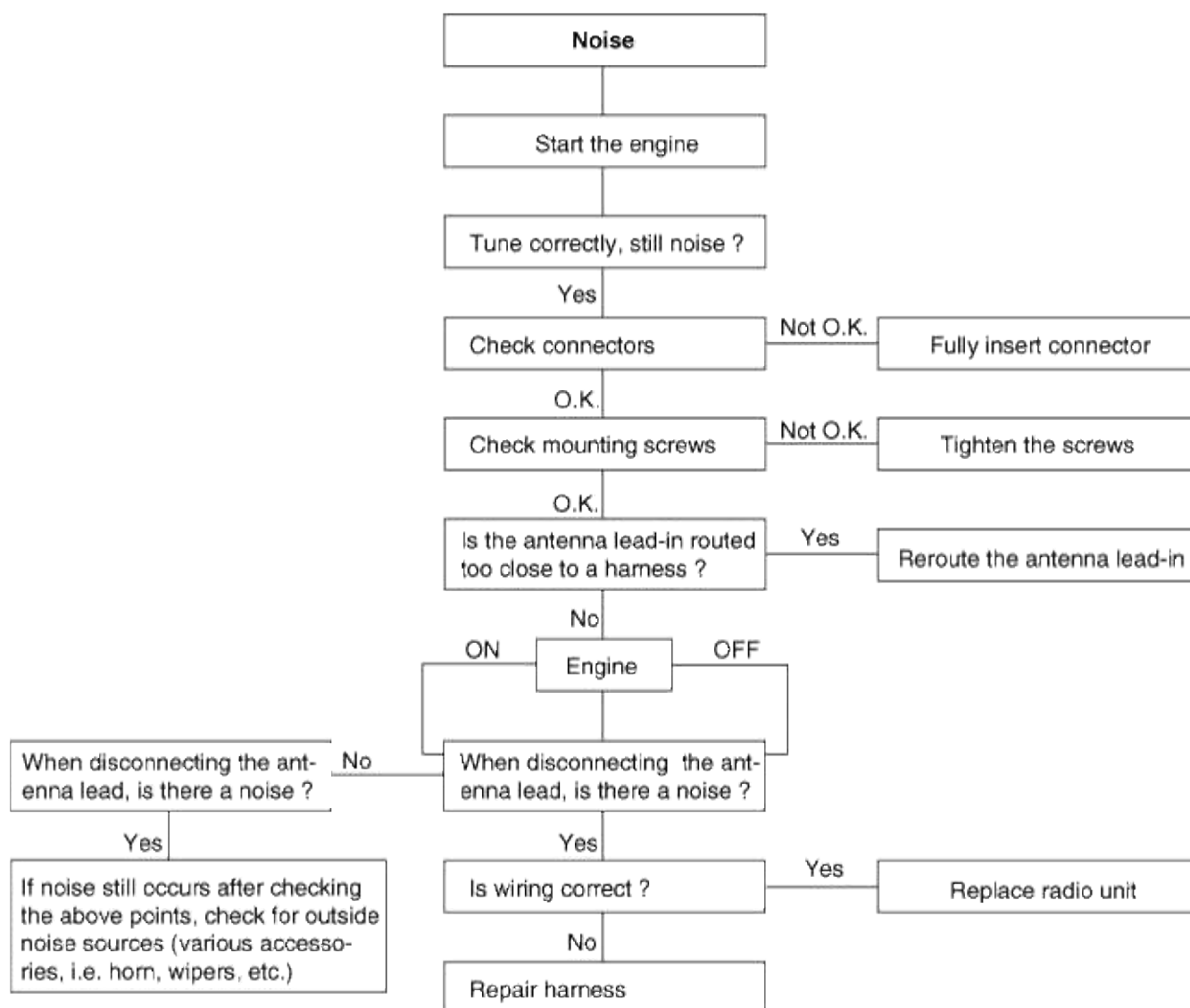
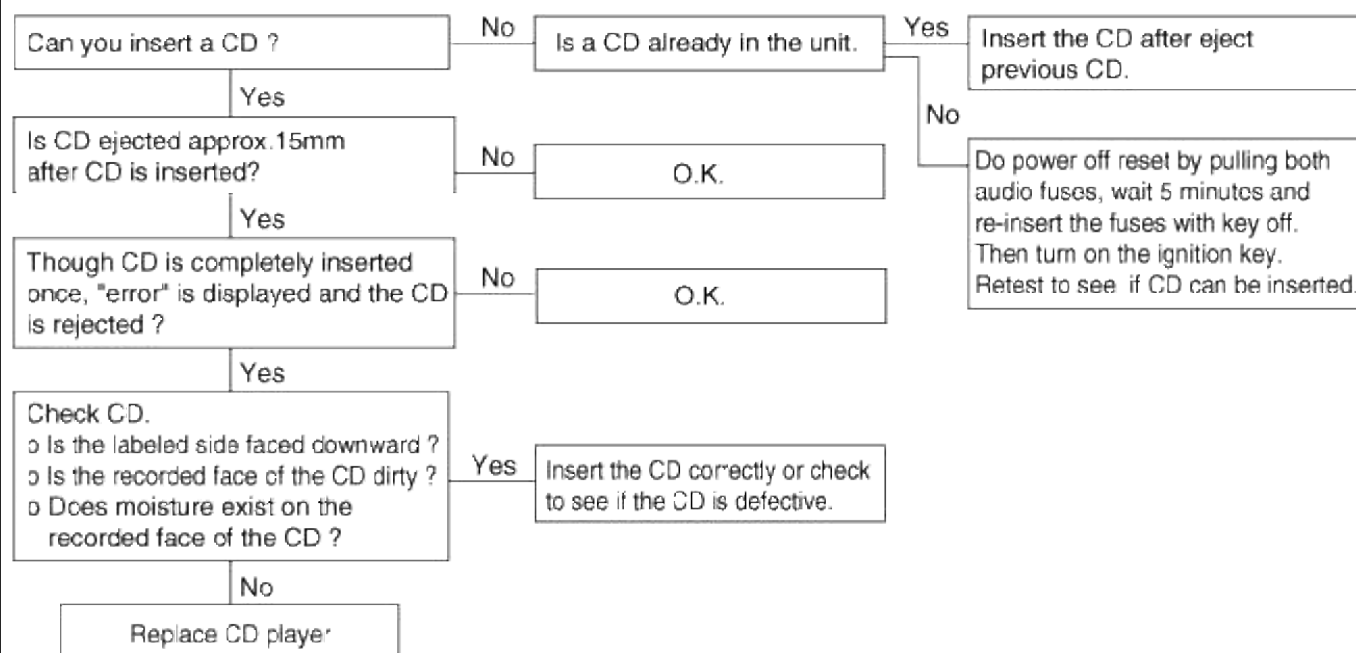
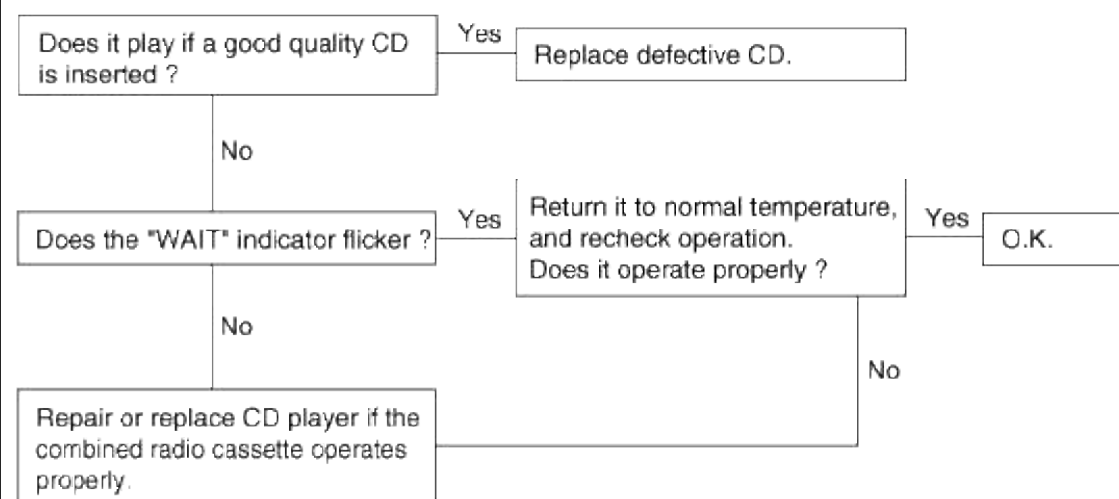


Chart 4

## 1. CD WILL NOT BE ACCEPTED

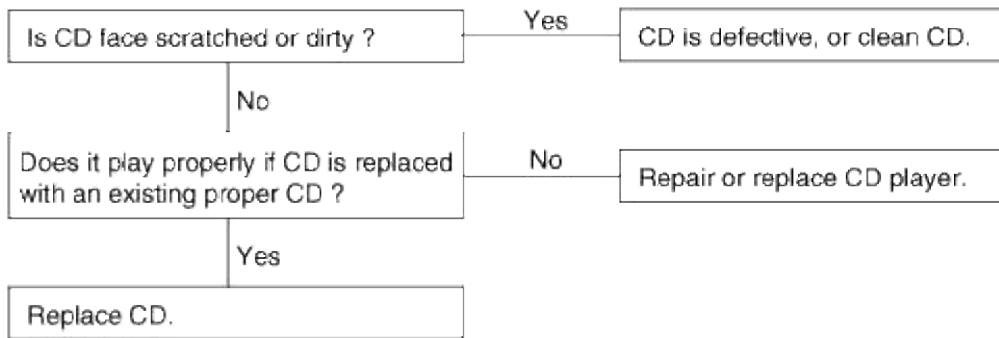


## 2. NO SOUND



### 3. CD SOUND SKIPS

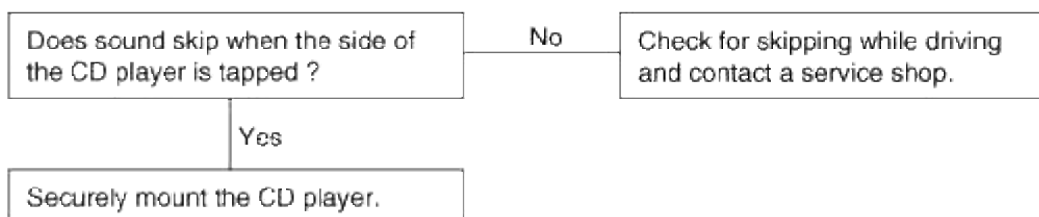
#### 1) Sound sometimes skips when parking.



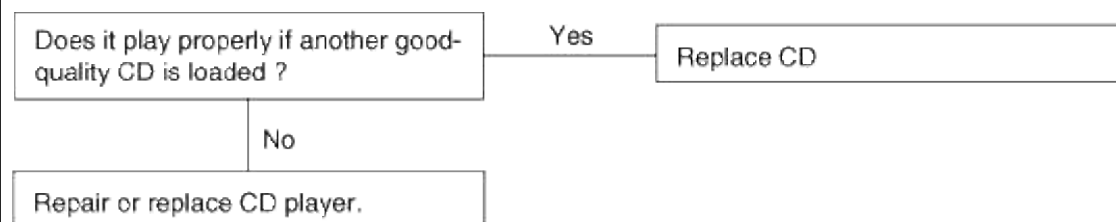
#### 2) Sound sometimes skips when driving.

(Stop vehicle, and check it.)

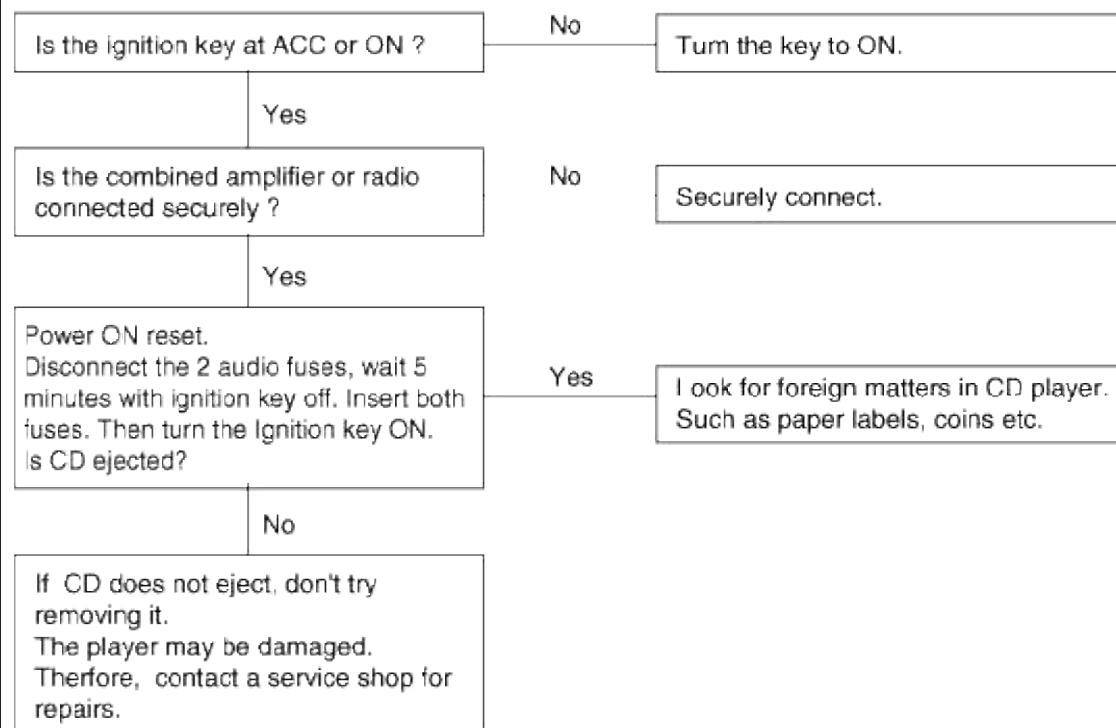
(Check by using a CD which is free of scratches, dirt or other damage.)



## 4. SOUND QUALITY IS POOR



## 5. CD WILL NOT EJECT



## 6. NO SOUND FROM ONE SPEAKER

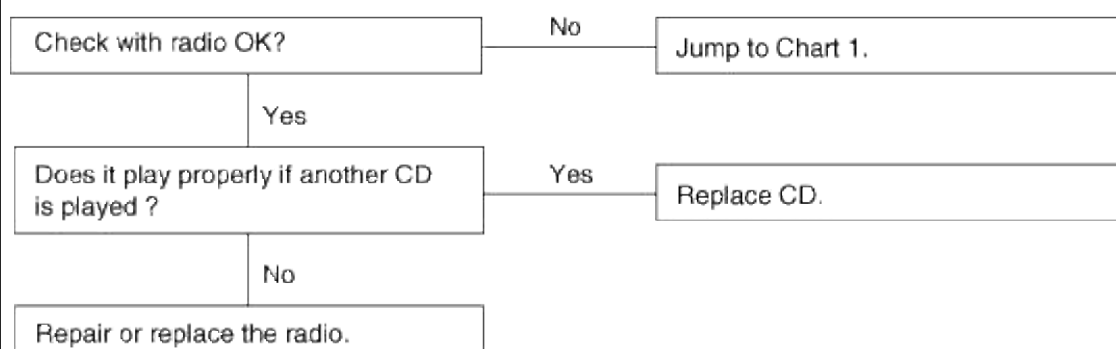


Chart 5

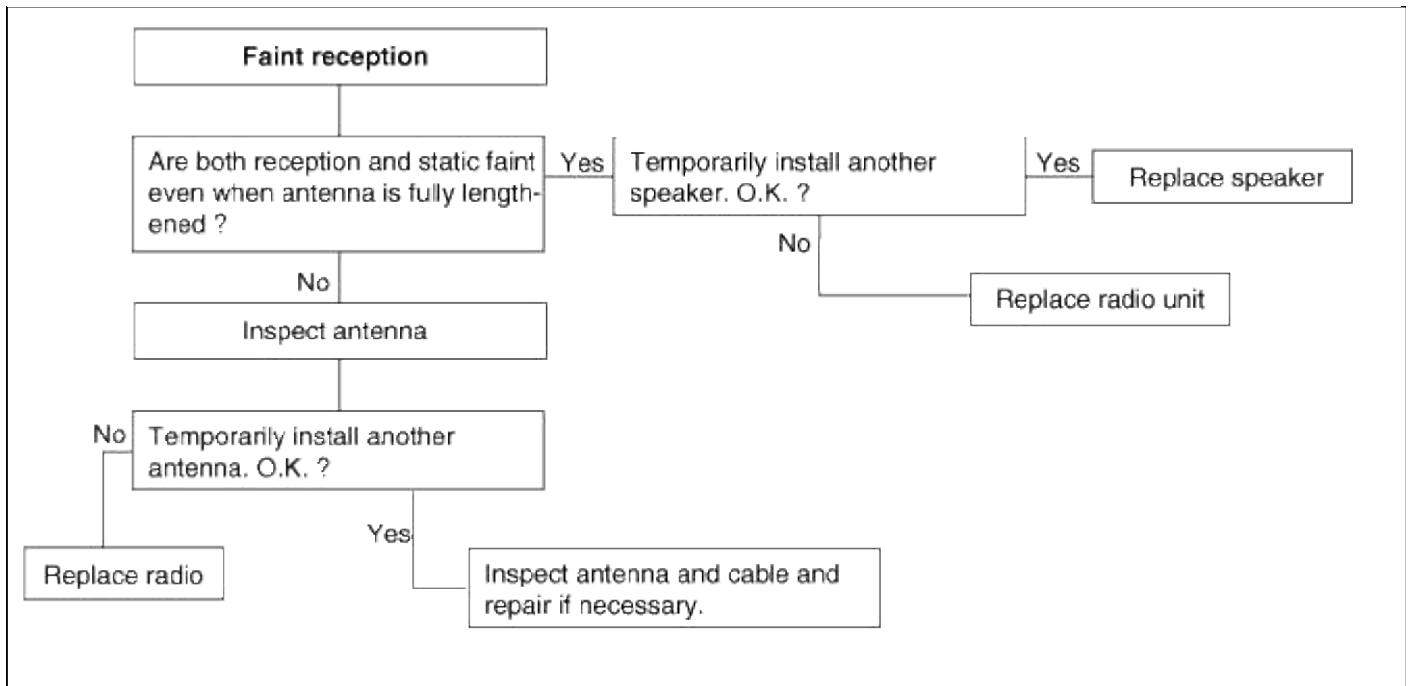


Chart 6

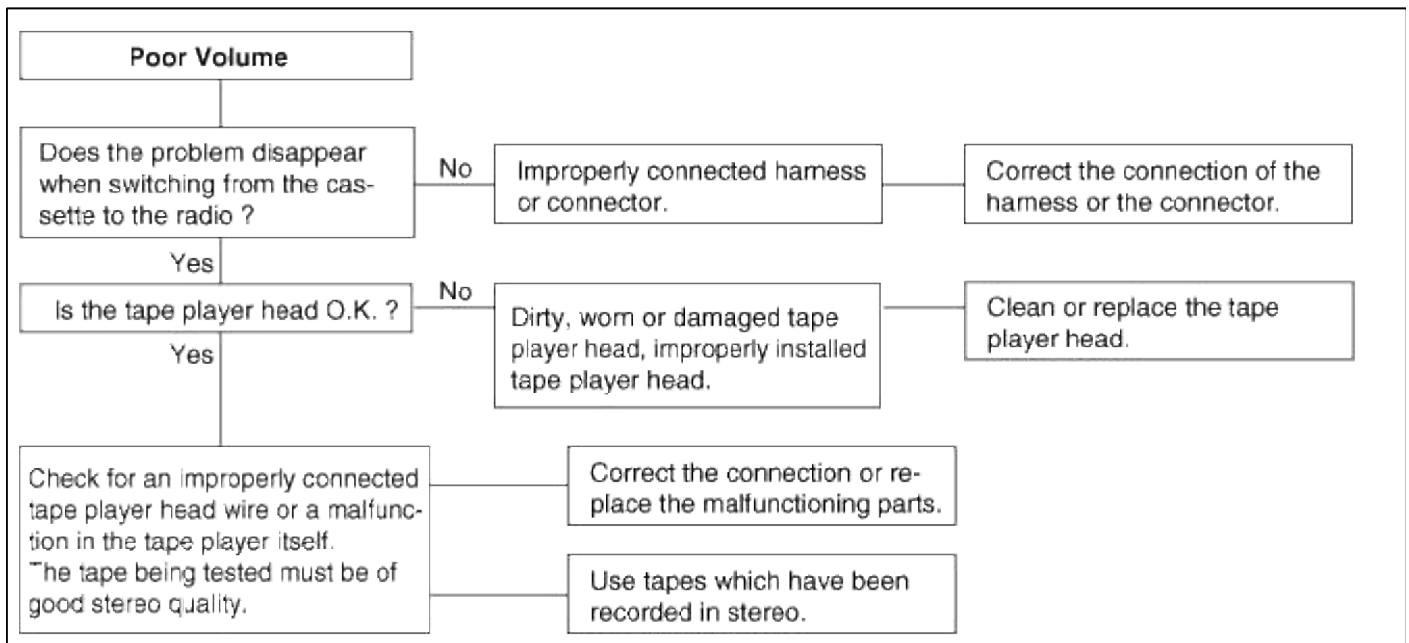
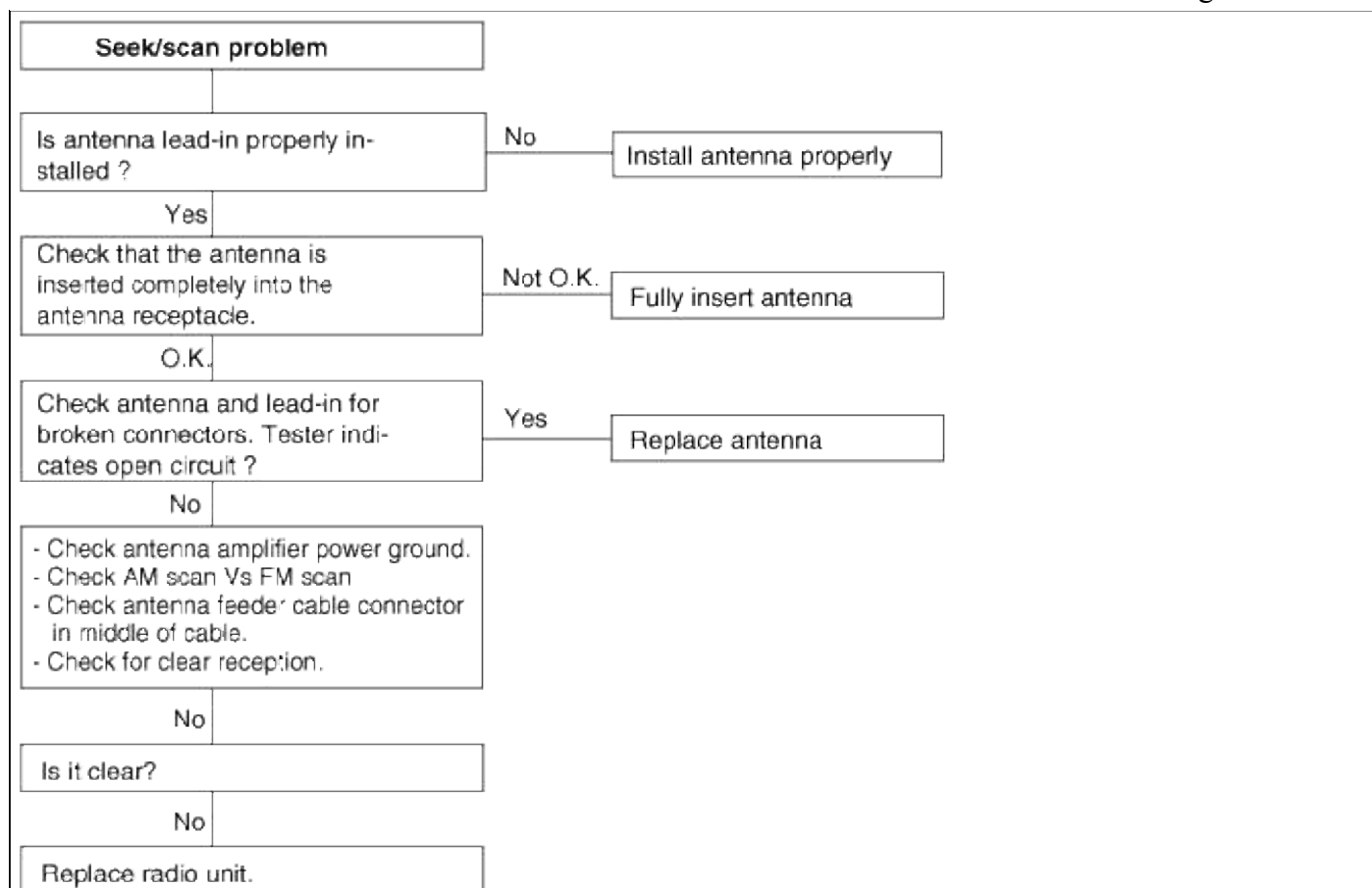


Chart 7



## Body Electrical System > Audio > Specifications

### SPECIFICATION

#### AUDIO

Item		Specification
Model		RADIO/CD/MP3 (D446)      RADIO/6CDC (D465)
Power supply		DC 14.4V
Output voltage		3.2 Vrms (Max) CD MODE
Load impedance		50kΩ x 4
Antenna		80PF 75Ω
Tuning type		PLL synthesized type
Amplifier		External amplifier
Frequency range / Channel space	FM	87.5~107.9 MHz / 200KHz
	AM	530~1710 KHz / 10KHz

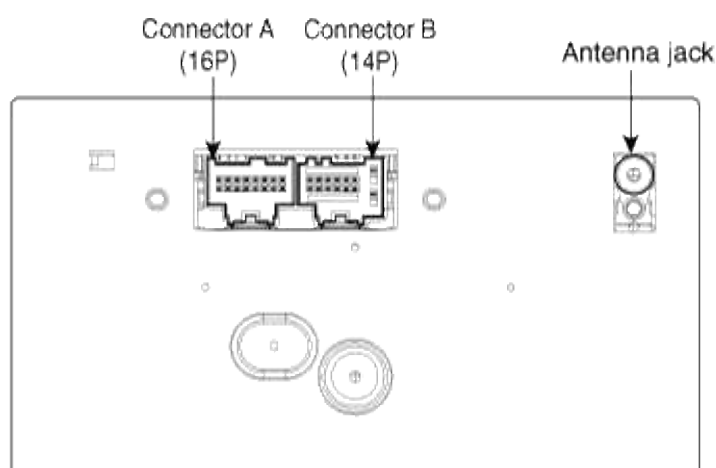
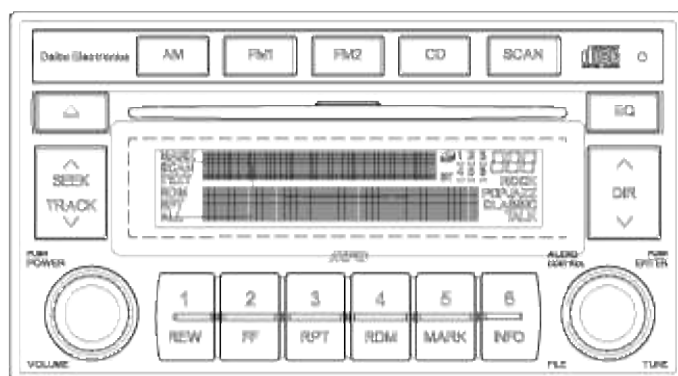
#### SPEACKER



Item		D446	D465
Input Power (W)	Front	43 (1WAY)	43 (1WAY)
	Rear	45 (2WAY)	45 (2WAY)
	Tweeter	30	30
Speaker Impedance( $\Omega$ )	Front	$4.0 \pm 0.6$ (1WAY)	$4.0 \pm 0.6$ (1WAY)
	Rear	$4.0 \pm 0.6$ (2WAY)	$4.0 \pm 0.6$ (2WAY)
	Tweeter	$4.0 \pm 0.6$	$4.0 \pm 0.6$
Speaker Number		6	6

**Body Electrical System > Audio > Audio Unit > Components and Components Location**
**COMPONENTS**

## [MP3 (D446)]



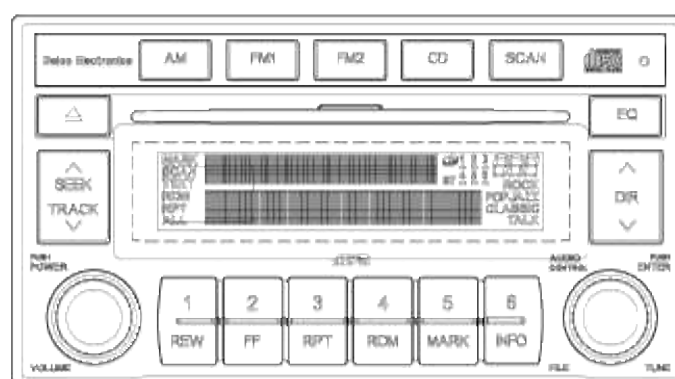
Connector A (16P)



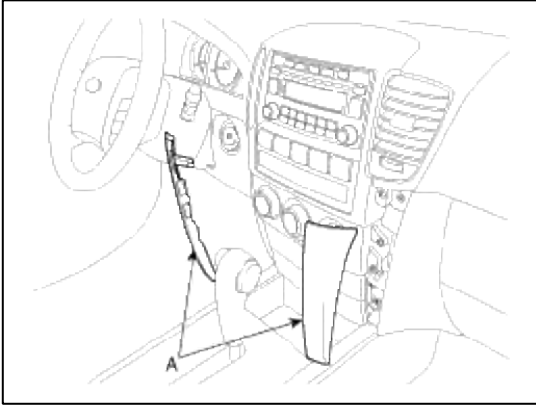
Connector B (14P)

Pin	Name	Pin	Name	Pin	Name	Pin	Name
1	Aux In SDAR(L) (Optional)	9	-	1	BATT	9	Tel MUTE
2	Aux In SDAR(R) (Optional)	10	-	2	-	10	-
3	Aux SDAR COM(Optional)	11	-	3	-	11	SWC
4	-	12	-	4	DIM+	12	SWC REF OUT
5	RF-	13	LF-	5	DIM-	13	MSCAN HIGH (Optional)
6	RF+	14	LF+	6	RmtEnable	14	MSCAN LOW (Optional)
7	LR-	15	RR-	7	ACC		
8	LR+	16	RR+	8	Ground		

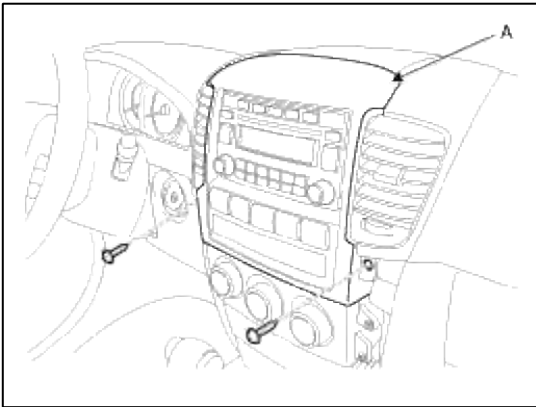
## [MP3 (D465)]



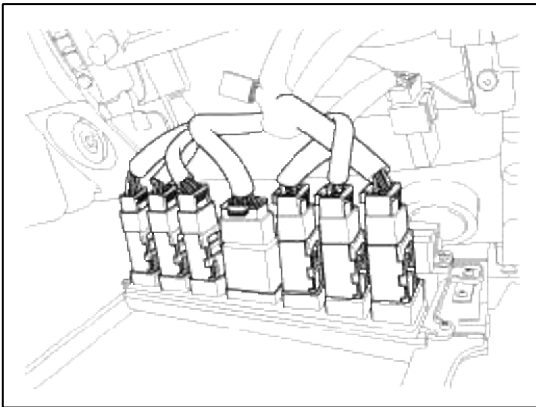
2. Remove the center facia lower panel (A). (Refer to Crash pad in BD group.) after pulling it by using regular screw driver (-) at part (A). Take care of fixing clips (B).



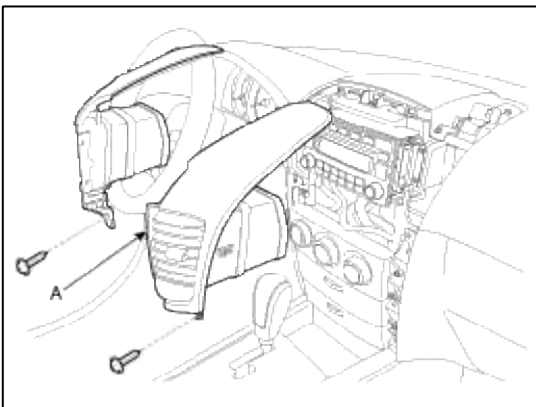
3. Remove the center facia panel (A) after loosening the screws. Avoid damaging retaining clips.



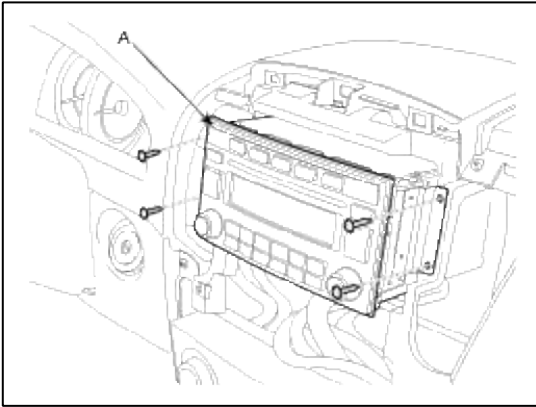
4. Remove the connectors of center facia panel.



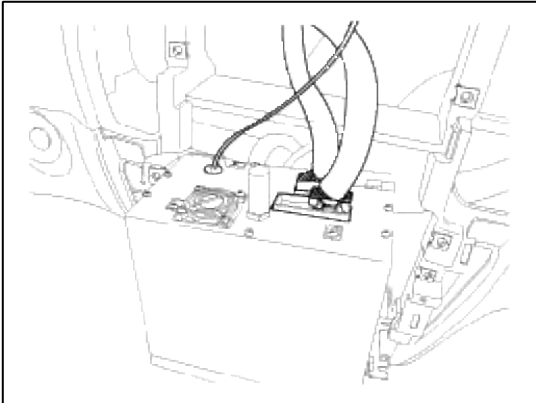
5. Remove the mounting screws then remove the center air vent (A).



6. Remove the mounting screws then remove the audio unit (A).



7. Remove the audio unit after disconnecting the audio connectors and cable.



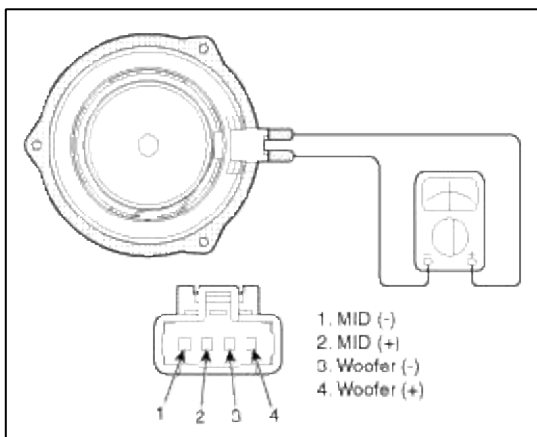
## INSTALLATION

1. Connect the audio connectors and cable to the audio unit
2. Fasten the audio mounting screws.
3. Reassemble the center air vent (A).
4. Reassemble the center facia panel after connecting the connectors.
5. Reassemble the center facia lower panel.
6. Connect the negative (-) battery terminal and then check the audio working.

## Body Electrical System > Audio > Speakers > Repair procedures

## INSPECTION

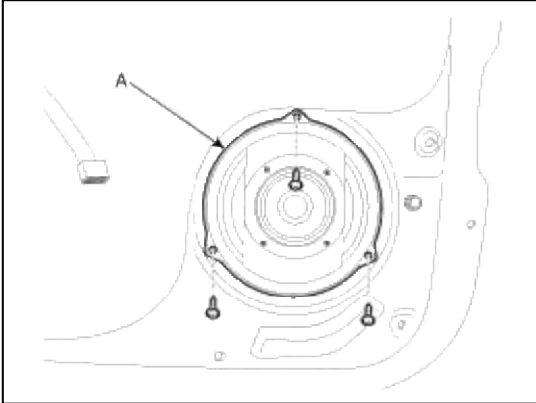
1. Check the speaker with an ohmmeter. If an ohmmeter indicates the correct impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is OK.
2. If a clicking sound is emitted from the speaker when the ohmmeter is connected to the speaker terminals, the speaker is OK.



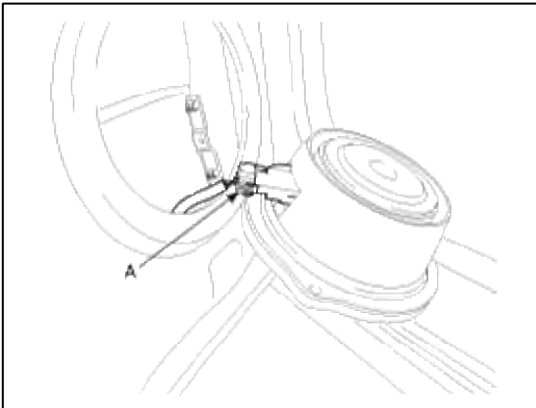
## REMOVAL

### FRONT SPEAKER

1. Remove the front door trim panel (Refer to the Front door in BD group.).
2. Remove the front speaker (A) after removing 3 screws.

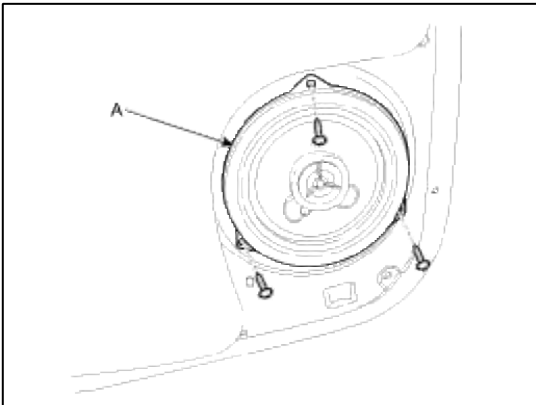


3. Remove the connector (A).

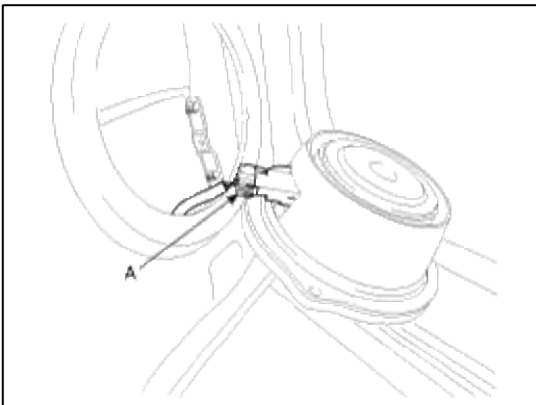


### REAR SPEAKER

1. Remove the rear door trim panel (Refer to the Rear door in BD group.).
2. Remove the rear speaker (A) after removing 3 screws rivets.

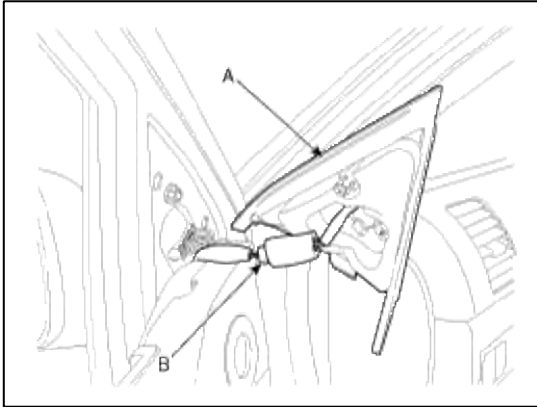


3. Disconnect the connector(A).



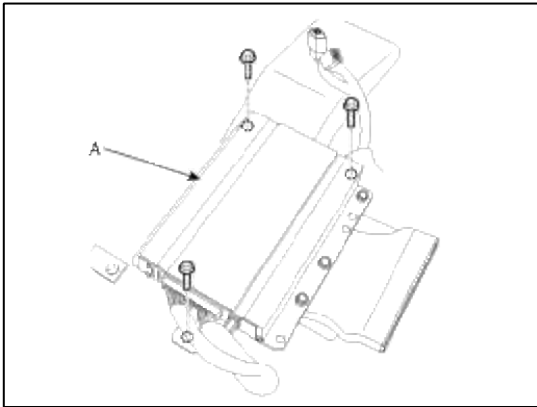
## TWEETER SPEAKER

1. Remove the tweeter speaker cover (A) and then disconnect the connector (B) (Refer to the Front door in BD group).



## EXTERNAL AMPLIFIER

1. Remove the driver seat. (Refer to the Front seats in BD group)
2. Remove the external amplifier (A) from the driver seat floor inner panel (A) after removing 3 bolts.



## INSTALLATION

### FRONT SPEAKER

1. Connect the connectors to the front speaker.
2. Reassemble the front speaker.
3. Reassemble the front door trim panel.

### REAR SPEAKER

1. Connect the connectors to the rear speaker.
2. Reassemble the rear speaker.
3. Reassemble the rear door trim panel.

### TWEETER SPEAKER

1. Connect the connectors and then reassemble the tweeter speaker.

### EXTERNAL AMPLIFIER

1. Reassemble the external amplifier on the driver seat floor
2. Reassemble the driver seat after connecting the connectors.

## Body Electrical System > Audio > Antenna > Repair procedures

### REMOVAL

1. Remove rod antenna from antenna mount by unscrewing rod antenna from mount.

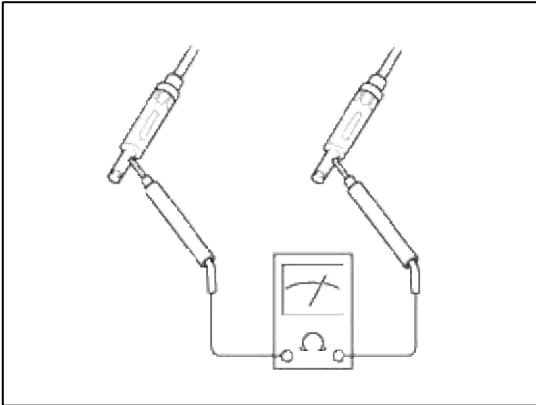
### INSTALLATION

1. Install rod antenna into antenna mount by screwing rod antenna into mount.

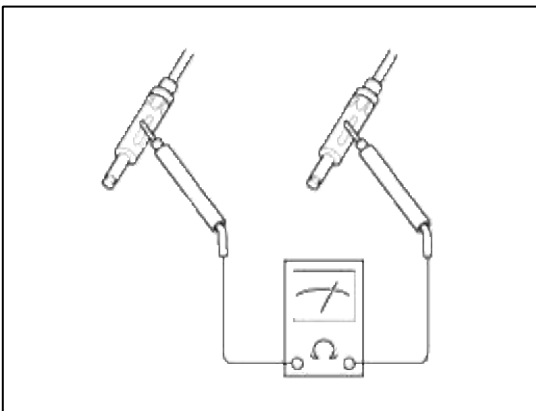
## INSPECTION

## ANTENNA CABLE

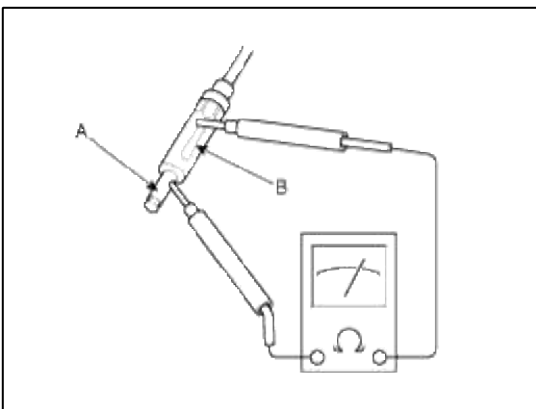
1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



3. Check for continuity between the outer poles of antenna cable. There should be continuity.



4. If there is no continuity, replace the antenna cable.
5. If there is no continuity, replace the antenna amplifier.
6. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.

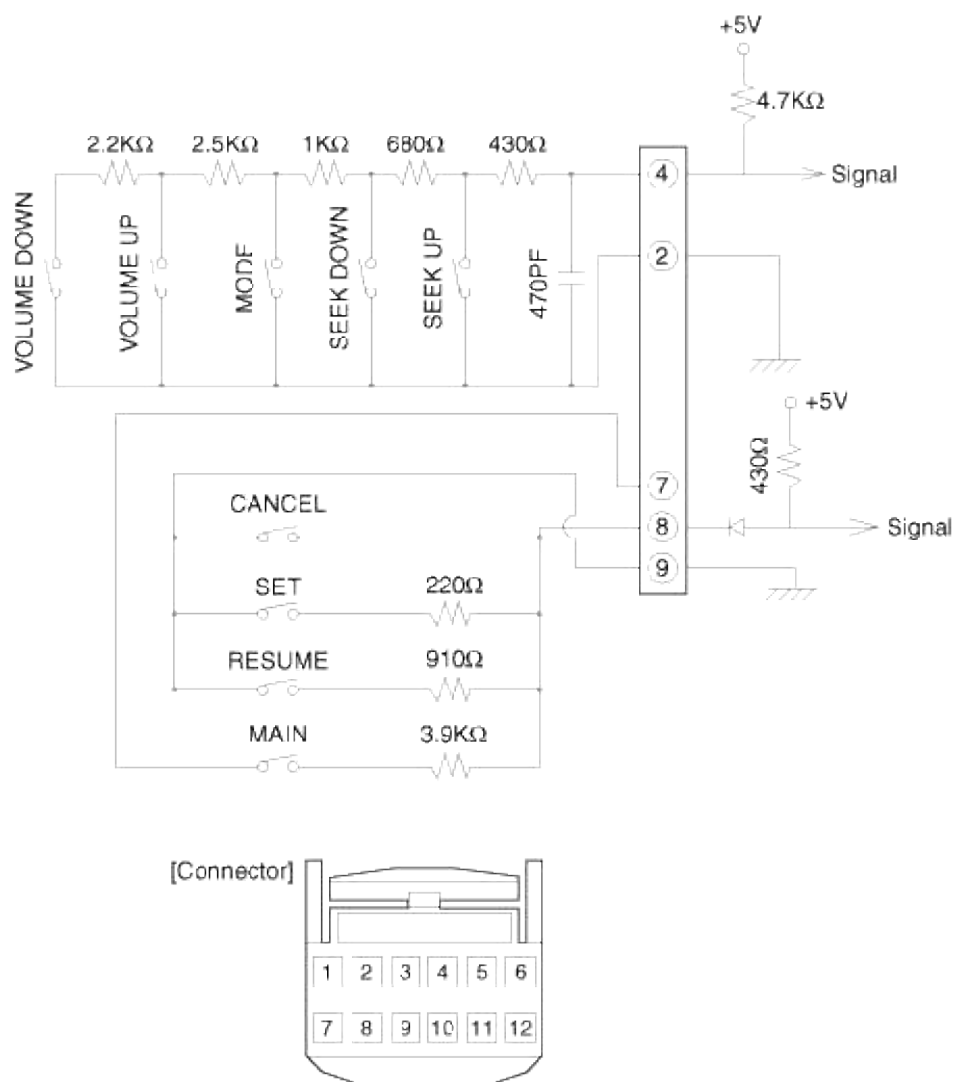


7. If there is continuity, replace the antenna cable.

**Body Electrical System > Audio > Audio Remote control > Schematic Diagrams**

## CIRCUIT DIAGRAM

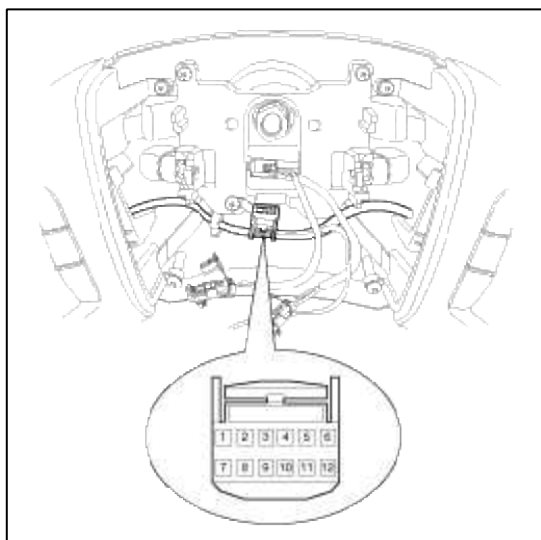




## Body Electrical System > Audio > Audio Remote control > Repair procedures

### INSPECTION

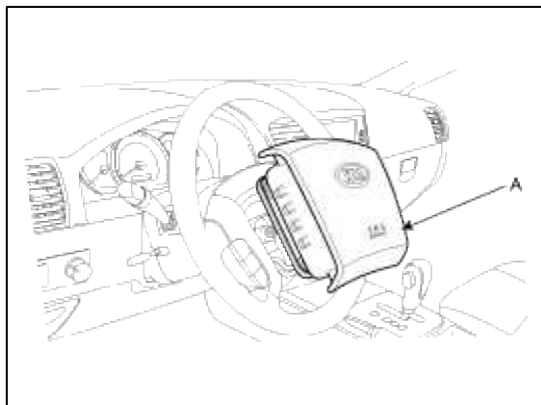
1. Check for resistance between No.2 and No.4 terminals in each switch position.



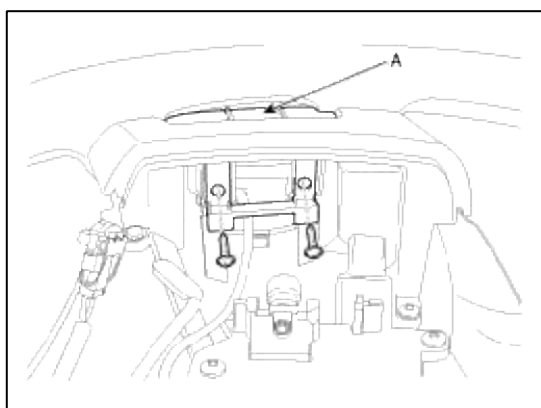
Switch name	Connector terminal	Resistance ( $\pm 5\%$ )
VOLUME DOWN	2 - 4	6.81 k $\Omega$
VOLUME UP	2 - 4	4.61 k $\Omega$
MODE	2 - 4	2.11 k $\Omega$
SEEK DOWN	2 - 4	1.11 k $\Omega$
SEEK UP	2 - 4	430 $\Omega$

## REMOVAL

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module (A). (Refer to the airbag group)



3. Remove the audio remote control switch (A) after remove the steering wheel remote control switch connector and 2 screws.

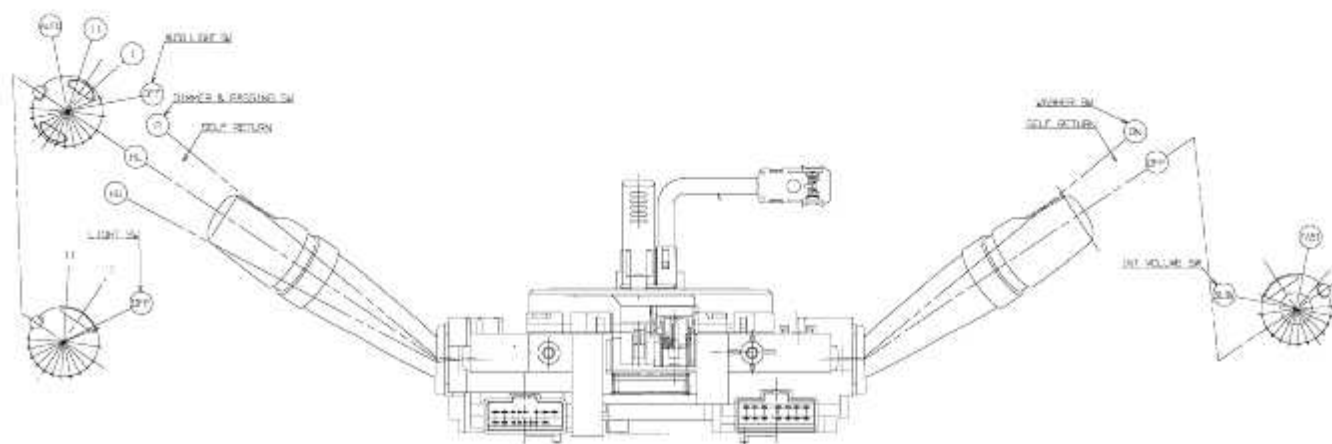
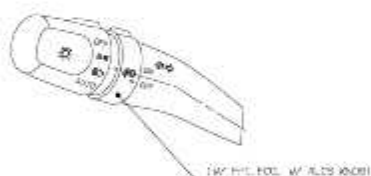
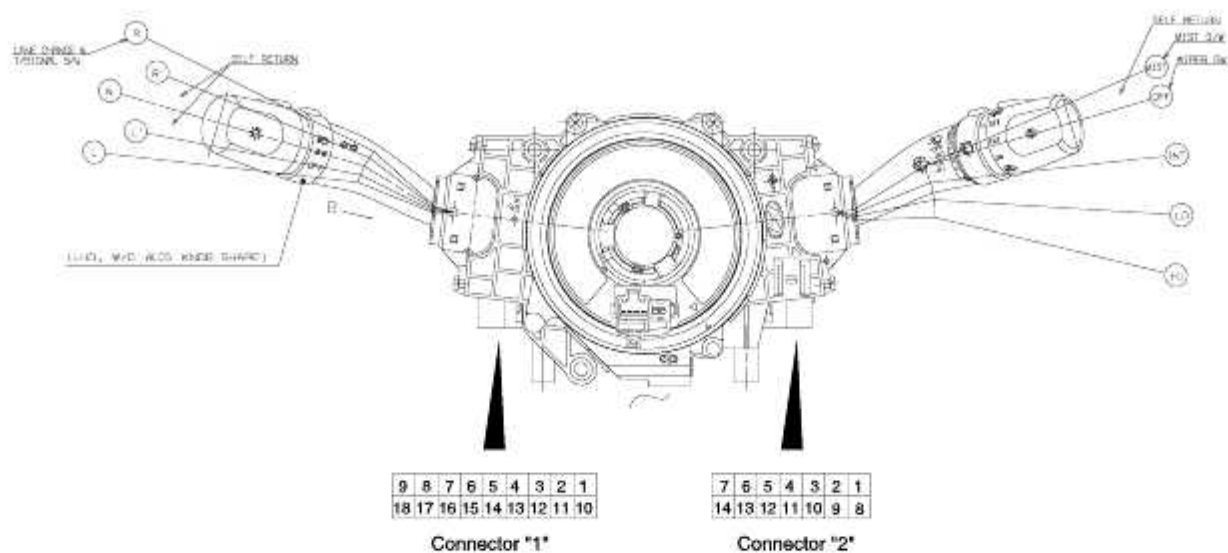


## INSTALLATION

1. Reassemble the audio remote control switch.
2. Connect the remote control switch connector.
3. Reassemble the driver airbag module and the negative (-) battery terminal.

**Body Electrical System > Multifunction switch > Multi Function Switch > Components and Components Location**

## COMPONENTS



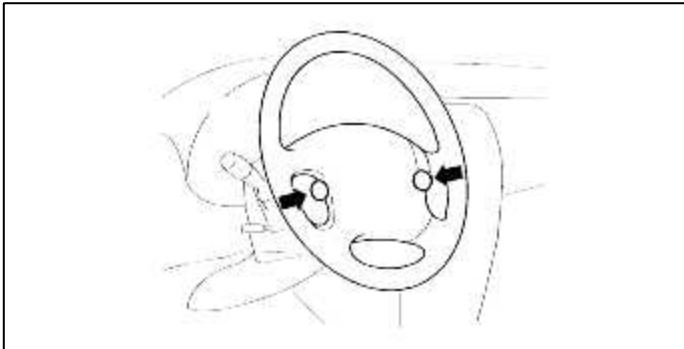
## Body Electrical System > Multifunction switch > Multi Function Switch > Repair procedures

### REMOVAL AND INSTALLATION

**CAUTION**

- Never attempt to disassemble or repair the air bag module or clock spring. If faulty, replace it.
- Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace if a dent, crack, deformation or rust is detected.
- The air bag module should be stored on a flat surface and placed so that the pad surface is facing upward. Do not place anything on top of it.
- Do not expose the air bag module to temperatures over 93°C(200°F).
- After deployment of an air bag, replace the clock spring with a new one.
- Wear gloves and safety glasses when handling an air bag that has been deployed.
- An undeployed air bag module should only be disposed of in accordance with the procedures mentioned in the restraints section.
- When you disconnect the air bag module-clock spring connector, take care not to apply excessive force.
- The removed air bag module should be stored in a clean, dry place.
- Prior to installing the clock spring, align the mating mark and "NEUTRAL" position indicator of the clock spring, and after turning the front wheels to the straight-ahead position, install the clock spring to the column switch. If the mating mark of the clock spring is not properly aligned, the steering wheel may not completely rotate during a turn, or the flat cable within the clock spring may be broken obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver. To inspect the clock spring, refer to the restraints section.

## 1. Remove the air bag module.



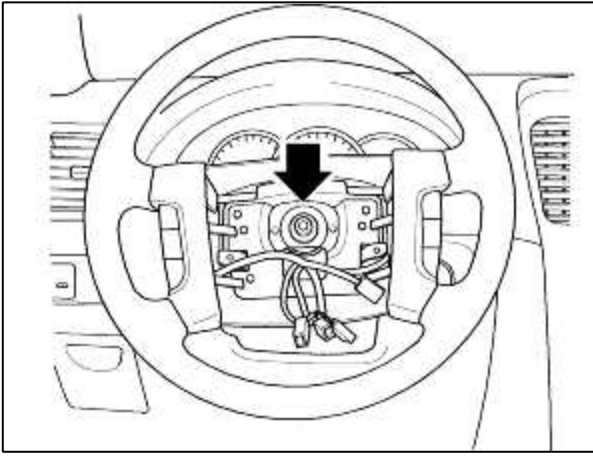

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Tightening torque

4 - 6Nm (40-60kg·cm, 2.9-4.4lb·ft)

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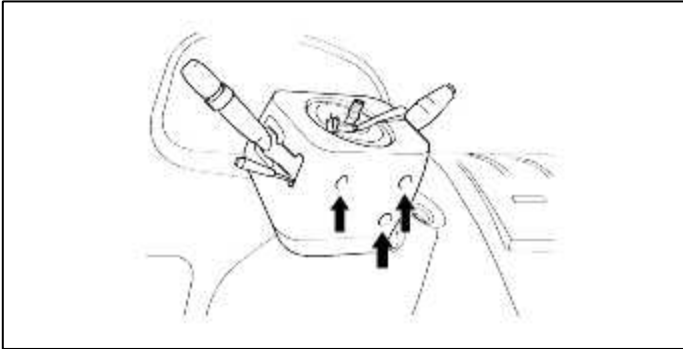
2. Remove the steering wheel.



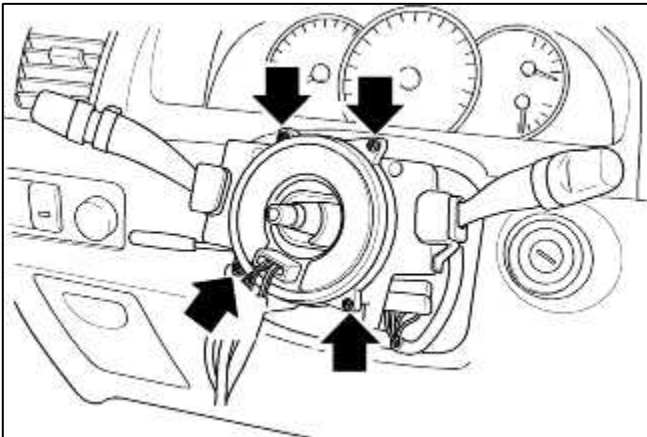
Tightening torque

40 - 50Nm (4.0-5.0kg·cm, 28-36lb·ft)

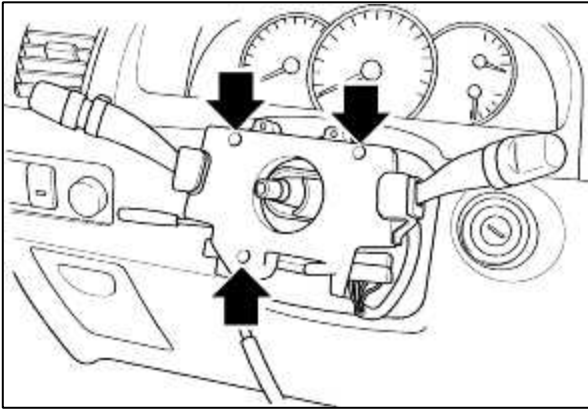
3. Remove the shroud side cover and then remove the steering column upper shroud and steering column lower shroud.



4. After removing the screws in the illustration, remove the clock spring.



5. Remove the 3 screws holding the multi function switch and disconnect the connectors. Remove the multi function switch assembly.



6. Installation is the reverse of removal.

## INSPECTION

### LIGHTING SWITCH [Connector "1"]

Terminal Position	14	13	11	12
OFF				
I	○	—	○	
II	○	○	○	○

### LIGHTING SWITCH (With Auto light) [Connector "1"]

Terminal Position	14	13	11	12
OFF				
I	○	—	○	
II	○	○	○	
Auto			○	○

### DIMMER AND PASSING SWITCH [Connector "1"]

Terminal Position	9	8	18	17
HU		○	—	○
HL			○	○
P	○	○	—	○

HU : Head lamp high beam  
 HL : Head lamp low beam  
 P : Head lamp passing switch

### TURN SIGNAL AND LANE CHANGE SWITCH [Connector "1"]

Terminal		3	2	1
Hazard switch	Turn signal switch			
OFF	L			
	N			
	R			

WIPER AND INTERMITTENT SPEED SWITCH [Connector "2"]

Terminal Position	7	6	5	2	3	8	9
OFF							
INT							
LOW							
HI							

WASHER SWITCH [Connector "2"]

Terminal Position	1	3
OFF		
ON		

MIST SWITCH [Connector "2"]

Terminal Position	3	4
OFF		
ON		

FRONT FOG SWITCH [Connector "1"]

Terminal Position	15	16
OFF		
ON		

REAR WIPER &amp; WASHER SWITCH [Connector "2"]

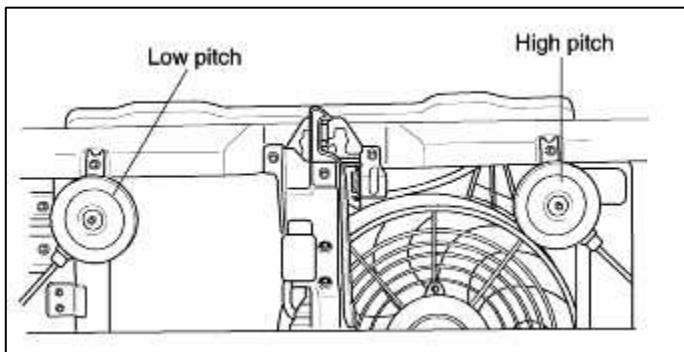


Terminal Position	10	11	12	13
Washer	○	—	—	○
OFF				
INT	○	○		
ON	○	—	○	
Washer	○	—	—	○

## Body Electrical System > Horn > Horn > Repair procedures

### REMOVAL AND INSTALLATION

1. Remove the bolts holding the horn and remove the horn assembly.



2. Installation is the reverse of removal.

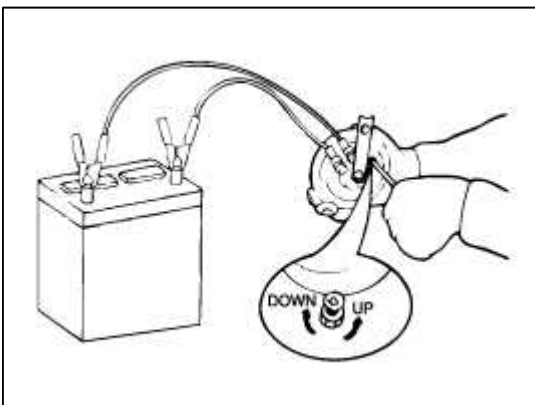
### INSPECTION

1. Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
2. The horn should make a sound. If the horn fails to make a sound, replace it.

### ADJUSTMENT

#### NOTE

After adjustment, apply a small amount of paint around the screw head to keep it from loosening.



## Body Electrical System > ETACS (Electronic Time > Specifications

### SPECIFICATIONS

Items	Specifications
Rated voltage	DC 12V
Operating voltage	DC 9 - 16V
Operating temperature	-30°C - 80°C
Insulation resistance	100MΩ or more
Rated load	
Tail lamp relay	DC 12V, 200mA (Relay load)
Rear defogger relay	DC 12V, 200mA (Relay load)
Hazard relay	DC 12V, 200mA (Relay load)
Power window relay	DC 12V, 200mA (Relay load)
Seat belt warning indicator	DC 12V, 200mA (Relay load)
Ignition key illumination	DC 12V, 200mA (Relay load)
Room lamp	DC 12V, 200mA (Relay load)
Intermittent wiper relay	DC 12V, 200mA (Relay load)
Rear cargo lamp	DC 12V, 1.4W (Lamp load)
Room lamp (Center)	DC 12V, 1.4W (Lamp load)
Drive door unlock actuator	DC 12V, 10W x 2(Lamp load)
	DC 12V, 200mA (Relay load)
	DC 12V, 10W (Lamp load)
	DC 12V, 10W (Lamp load)
	DC 12V, 7A

### Remote keyless Entry

Items	Specifications
Keyless entry transmitter	
Power source	Lithium 3V battery (1EA)
Transmissible distance	5m or more
Life of battery	2 years or more (at 10 times per day)
Button	Door lock / unlock, rear hatch glass open, panic
Frequency	315MHz ± 250 MHz

### Body Electrical System > ETACS (Electronic Time > ETACS Module > Schematic Diagrams

#### ETACS PIN NO. AND DESCRIPTION

6	5	4				3	2	1
15	14	13	12	11	10	9	8	7

Connector "A"

10	9	8	7	6				5	4	3	2	1
23	22	21	20	19	18	17	16	15	14	13	12	11

Connector "B"

6	5	4				3	2	1
14	13	12	11	10	9	8	7	

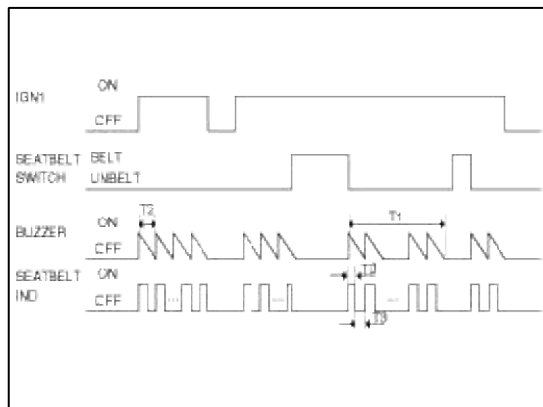
Connector "C"

PIN NO.	CONNECTOR "A"	PIN NO.	CONNECTOR "B"	PIN NO.	CONNECTOR "C"
A1	Remote key setting terminal	B1	TNS switch	C1	-
A2	ACC	B2	Passenger door actuator switch	C2	Seat belt warning lamp
A3	Keyless switch	B3	Seat belt switch	C3	Rear hatch glass open relay
A4	Driver door switch	B4	Main door switch (LOCK)	C4	Door lock fuse
A5	Rear hatch switch	B5	Driver door key switch (LOCK)	C5	Driver left door unlock
A6	Rear defroster switch	B6	Horn relay	C6	Door lock relay (LOCK)
A7	B+	B7	Rear defroster relay	C7	Front windshield defroster relay
A8	IG1	B8	Wiper relay	C8	Ignition key hole lamp
A9	Crash unlock	B9	Wiper switch	C9	Ground
A10	Speed sensor	B10	TNS relay	C10	Rear hatch open warning lamp
A11	Rear door switch	B11	Drive door actuator switch	C11	Room lamp
A12	Passenger door switch	B12	Front windshield defroster switch	C12	ALT "L"
A13	Rear hatch key switch (LOCK)	B13	Head lamp switch	C13	-
A14	Rear hatch glass switch	B14	Main door switch (UNLOCK)	C14	Door lock relay (UNLOCK)
A15	-	B15	Driver door key switch (UNLOCK)		
		B16	Door warning lamp		
		B17	-		
		B18	-		
		B19	Hazard relay		
		B20	Power window relay		
		B21	Wiper switch		
		B22	Wiper switch		
		B23	Ground		

**Body Electrical System > ETACS (Electronic Time > ETACS Module > Description and Operation**
**OPERATION**

## 1. SEAT BELT WARNING TIMER

- (1) When IGN1 ON & SEAT BELT is not being worn, WARNING IND is blinking as cycle of 0.6s and BUZZER is outputting for 6s.
- (2) When IGN1 SWITCH is OFF during OUTPUT, SEAT BELT WARNING IND and BUZZER shall stop the output immediately.
- (3) When SEAT BELT is wearing during the worn light or alarm output, STOP the output of IND & BUZZER.
- (4) In case of IGN1 SWITCH ON, after wearing SEAT BELT and then removing, WARNING IND is blinking as cycle of 0.6s and BUZZER is outputting for 6s.
- (5) When IGN ON during wearing SEAT BELT, don't output IND & BUZZER are not on.



T1 :  $6 \pm 1$  sec.

T2 :  $1 \pm 0.1$  sec,

T3 :  $0.3 \pm 0.1$  sec.

## 2. REMOTE KEYLESS ENTRY control

Operate LOCK / UNLOCK of DOOR and TAIL GATE GLASS, PANIC by REMOCON.

A. Operate in state of KEY IN SWITCH OUT & ACC SWITCH OFF & IGN1 SWITCH OFF & IGN2 SWITCH OFF.

B. By receiving LOCK, UNLOCK, TAIL GATE GLASS, PANIC signal from transmitter, output LOCK / UNLOCK of DOOR and TAIL GATE GLASS OPEN, PANIC.

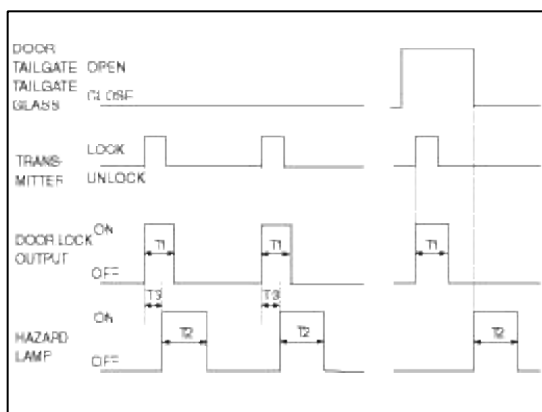
### (1) TRANSMITTER LOCK FUNCTION

A. In case of removing IGN KEY from CYLINDER and all Door is CLOSE, when receiving TRANSMITTER LOCK signal, start the operation of LOCK output and after T3 from the starting point of operation and then checking the state of LOCK SWITCH, ON the output of HAZARD LAMP for 1s one time.

B. In state of any of DOOR, TAIL GATE, TAIL GATE GLASS is OPEN, when receiving TRANSMITTER LOCK signal, output LOCK only, don't output HAZARD LAMP.

C. After b), in case of OPEN > CLOSE, ON the output of HAZARD LAMP one time.

D. In state of Driver and Assist(North America ONLY) DOOR LOCK, when receiving TRANSMITTER LOCK signal, output HAZARD LAMP for 1s one time after re-outputting LOCK.



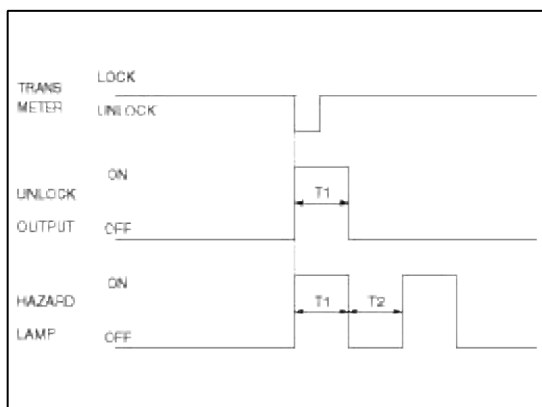
T1 :  $0.5 \pm 0.1$  sec,

T2 :  $1.0 \pm 0.2$  sec,

T3 :  $0.2 \pm 0.04$  sec.

## (2) TRANSMITTER UNLOCK FUNCTION

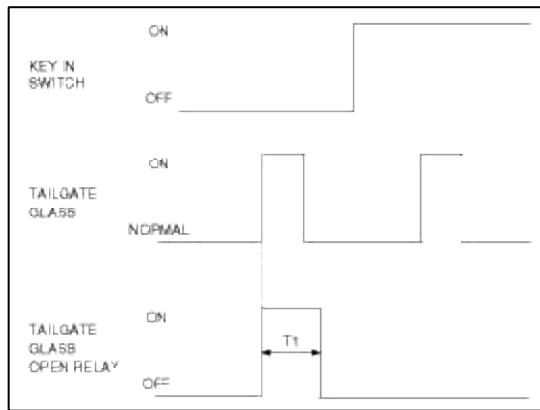
- A. When receiving TRANSMITTER UNLOCK signal, output UNLOCK and ON the output of HAZARD LAMP as cycles of 0.5s and 0.5s (ON/OFF) two times.
- B. In state of Driver and Assist(North America ONLY) DOOR UNLOCK, when receiving TRANSMITTER UNLOCK, ON the output of HAZARD LAMP as cycles of 0.5s and 0.5s (ON/OFF) two times after outputting UNLOCK.
- C. After TRANSMITTER UNLOCK and then there are no inputs of Entering (DOOR, TAIL GATE, TAIL GATE GLASS) OPEN within 30s, lock them automatically and ON the output of HAZARD LAMP for 1s one time. And in case of TRANSMITTER UNLOCK within 30s once more, extend the time for about 30s. (regardless the state of KNOB within 30s)  
But, after TRANSMITTER UNLOCK and then insetting KEY within 30s, cancel 30s TIMER. (After the initial TRANSMITTER UNLOCK without LOCK, HAZARD output, and after keeping the output of ROOM LAMP for 30s, turn out the light 2s)



T1, T2 :  $0.5 \pm 0.1$  sec.

### (3) TRANSMITTER TAIL GATE GLASS OPEN FUNCTION

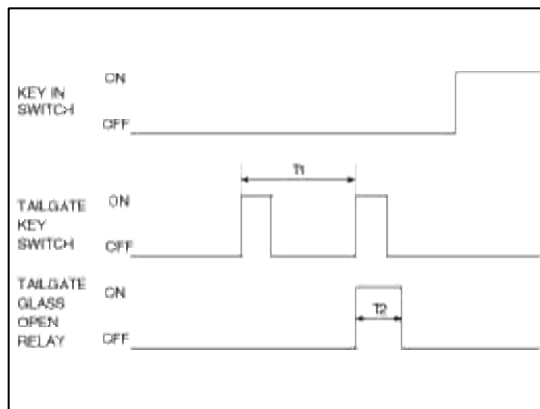
- A. In state of removing IGN KEY from CYLINDER and inputting TAIL GATE GLASS OPEN signal of TRANSMITTER, ON the output of TAIL GATE GLASS OPEN RELAY for 0.5s.
- B. In state of TAIL GATE GLASS OPEN, turn on TAIL GATE WARNING LAMP and ROOM LAMP.



T1 :  $0.5 \pm 0.1$  sec.

#### (4) TAIL GATE GLASS OPEN FUNCTION (NON- RKE)

- A. In state of removing IGN KEY from CYLINDER and INPUT of TAIL GATE KEY SWITCH is inputting within T1 2 times, ON the output of TAIL GATE GLASS OPEN RELAY for 0.5s.
- B. In state of TAIL GATE GLASS OPEN, turn on TAIL GATE WARNING LAMP and ROOM LAMP.



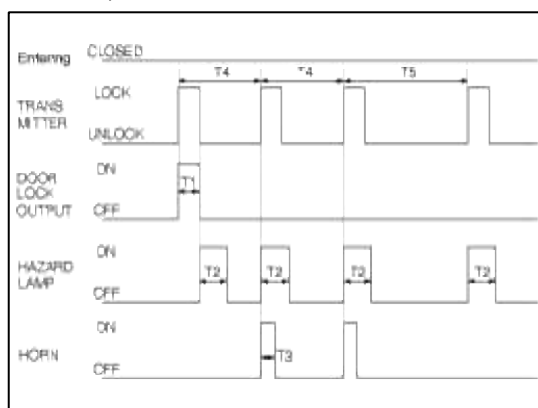
T1 :  $3.0 \pm 0.5$  sec,

T2 :  $0.5 \pm 0.1$  sec.

(5) HORN ANSWER BACK

In state of LOCK by TRANSMITTER, when receiving TRANSMITTER LOCK signal within 4s after receiving the final TRANSMITTER LOCK signal, output HORN one time (0.03s)

(When receiving SAFETY KNOB UNLOCK, DOOR or T/G OPEN, TRANSMITTER UNLOCK, TRANSMITTER T/G GLASS OPEN signal within 4s after receiving TRANSMITTER LOCK signal, RESET.)

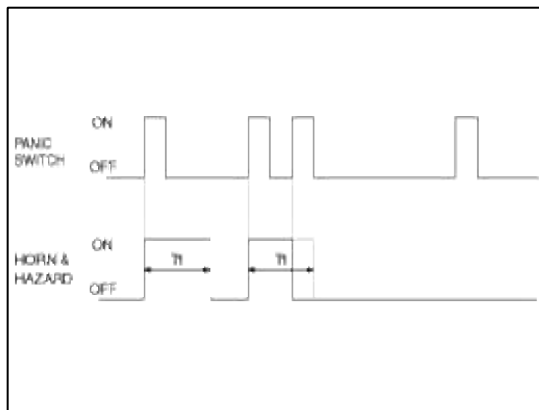

$$T1 : 0.5 \pm 0.1 \text{ sec.}$$

T2 :  $1 \pm 0.2$  sec,

T3 :  $30.0 \pm 5$  msec,  
 T4 : within  $4 \pm 1$ s,  
 T5 : more than  $4 \pm 1$ s

#### (6) PANIC ALARM

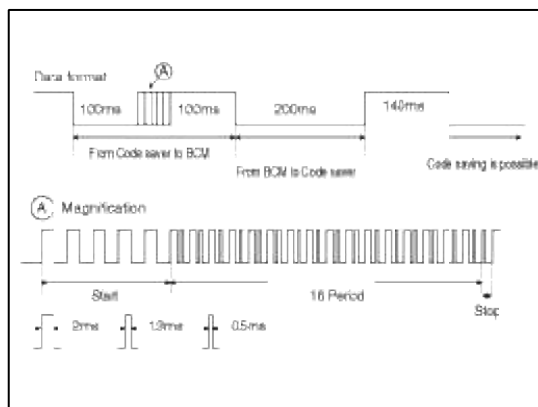
- A. When receiving TRANSMITTER PANIC signal, ON the PANIC ALARM by using HORN and HAZARD for T1.
- B. During PANIC alarm, when receiving (TRANSMITTER LOCK / TRANSMITTER UNLOCK / TRANSMITTER PANIC / TRANSMITTER TAIL GATE GLASS OPEN / KEY IN / DRIVER KEY UNLOCK, DRIVER KEY LOCK) signal, OFF PANIC Alarm.
- C. During PANIC alarm, even if receiving the other TRANSMITTER registered, regard it as the same TRANSMITTER.
- D. After RELOCKING by TRANSMITTER UNLOCK, when all the door (4DOOR, TAIL GATE, TAIL GATE GLASS) is closed and all KNOB is LOCK, OFF PANIC Alarm.



T1 :  $30 \pm 3$  sec.

### 3. RKE CODE SAVE function

#### (1) CODE SAVER COMMUNICATION SPEC

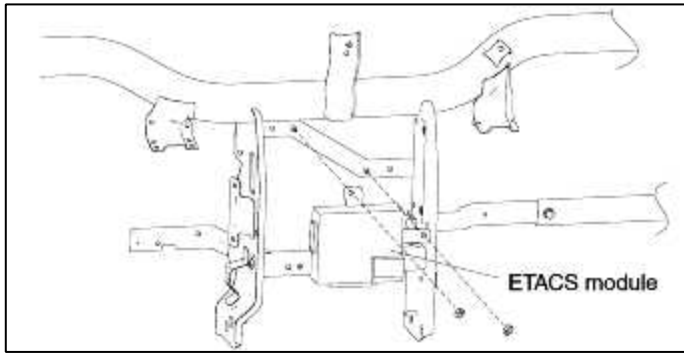


### Body Electrical System > ETACS (Electronic Time > ETACS Module > Repair procedures

#### REMOVAL AND INSTALLATION

1. Disconnect the negative (-) battery terminal.
2. Remove the audio unit (Refer to BD group).

3. Remove the 2 nuts holding the ETACS module and disconnect the connectors.

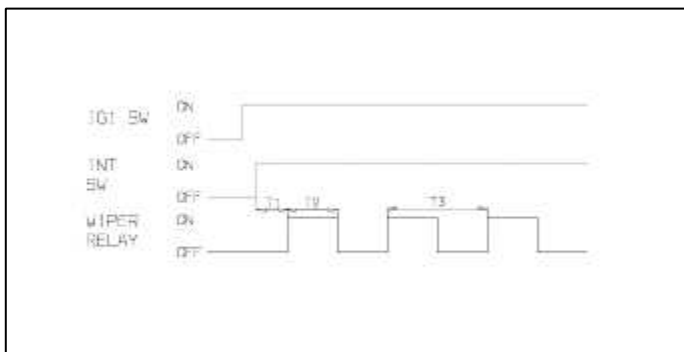


4. Installation is the reverse of removal.

## INSPECTION

### ETACS FUCTION

1. Intermittent wiper



Time specification

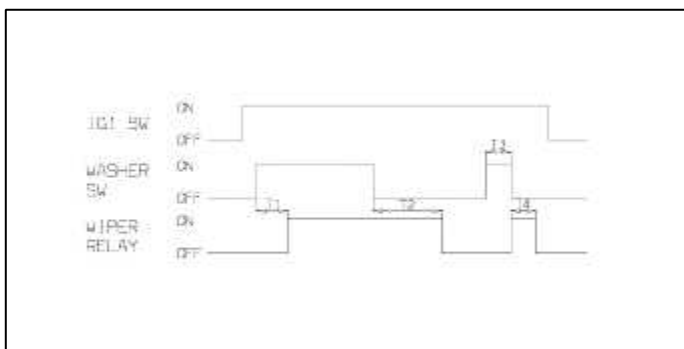
T1 : Max. 0.3 sec.

T2 :  $0.7 \pm 0.1$  sec. (Time of wiper motor 1 rotation)

T3 : (Intermittent time) : T2 + FAST ( $2.0 \pm 0.2$  sec.)

T2+SLOW ( $10 \pm 1.0$  sec.)

2. Washer related wiper.



Time specification.

T1 :  $0.6 \pm 0.1$  sec.

T2 : 2.5 - 3.8 sec.

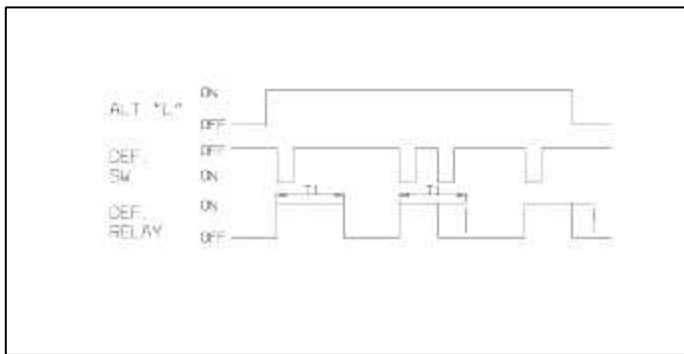
T3 : 0.2 - 0.6 sec.

T4 :  $0.7 \pm 0.1$  sec.

This function should be operated preferentially even though the variable intermittent wiper is operating.



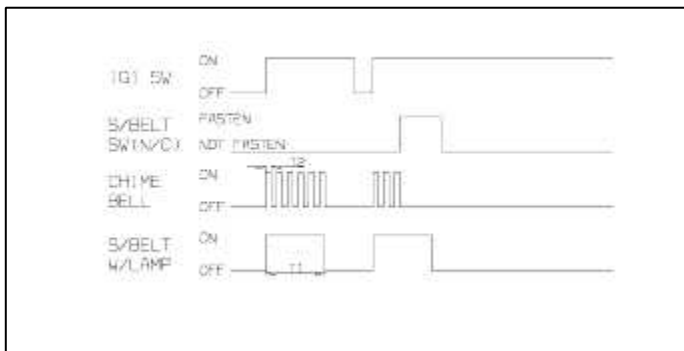
## 3. Rear window defroster and front windshield defroster.



Time specification

T1 :  $20 \pm 1$  min.

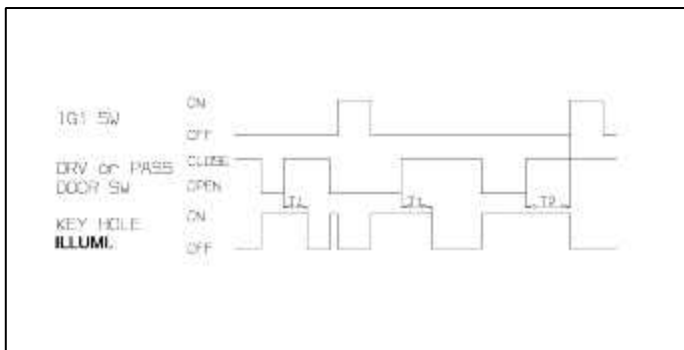
## 4. Seat belt warning



Time specification

T1 :  $6 \pm 1.5$  sec.T2 :  $0.5 \pm 0.1$  sec.

## 5. Ignition key hole illumination

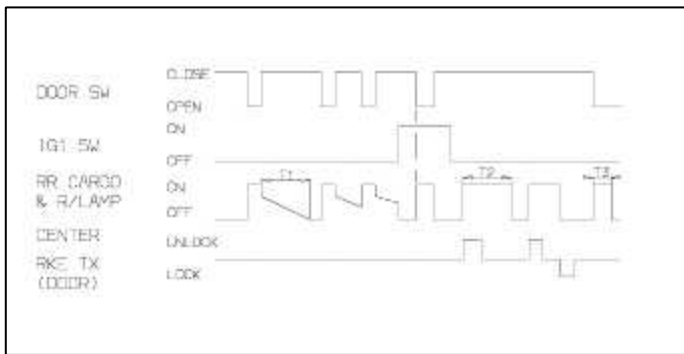


Time specification

T1 :  $10 \pm 1$  sec.

T2 : 0 - 10 sec.

## 6. Delayed out room lamp



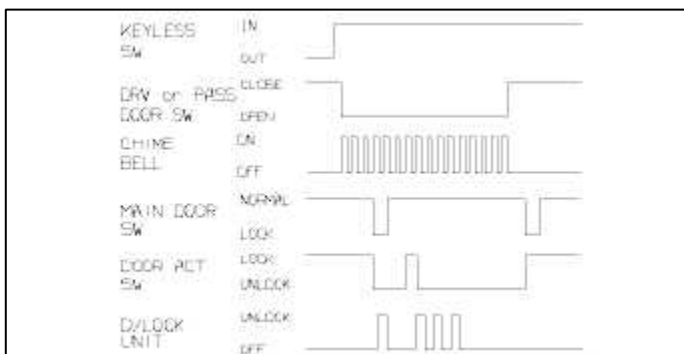
Time specification

T1 : 5 - 6 sec.

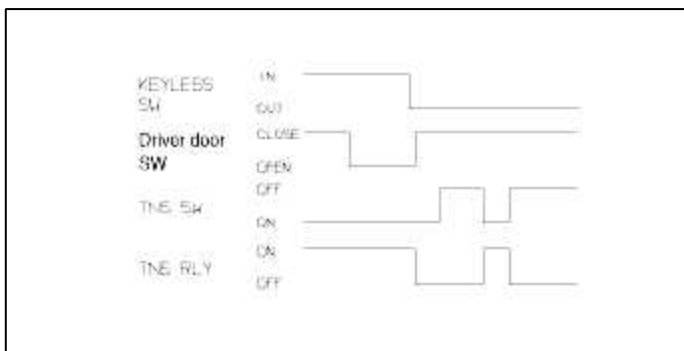
T2 : 30 ± 3 sec.

T3 : 20 ± 2 min.

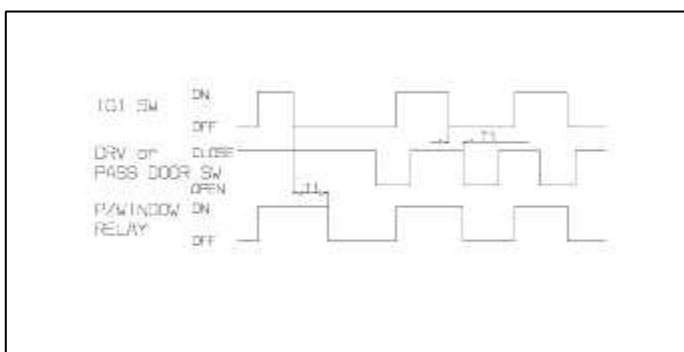
## 7. Ignition key reminder



## 8. Battery saver.



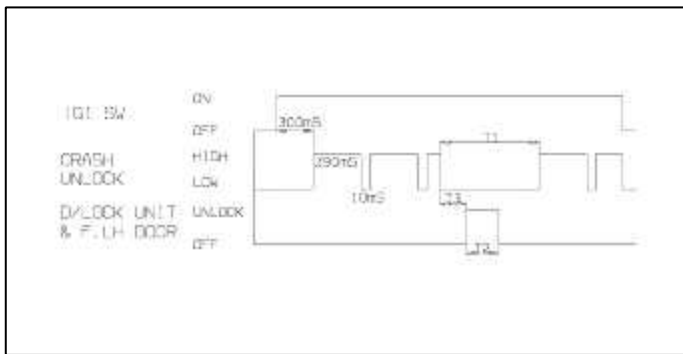
## 9. Power window timer



Time specification

T1 : 30 ± 3 sec.

## 10. Crash door unlock



Time specification

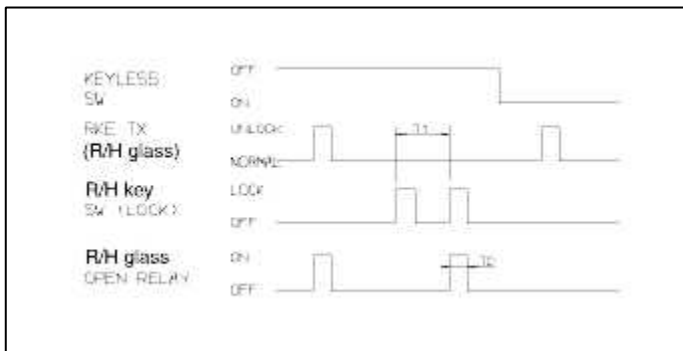
T1 : 200msec.

T2 :  $0.5 \pm 0.1$  sec.T3 :  $60 \pm 2$  msec.

## 11. Door ajar

Alarm occurs while the door or rear hatch opened when the vehicle speed is 5km/h over.

## 12. Rear hatch glass open



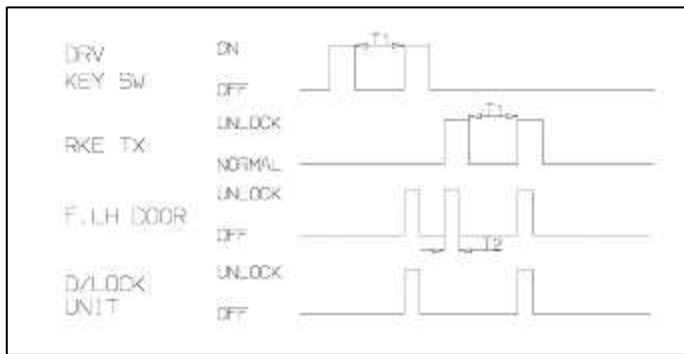
Time specification

T1 :  $3 \pm 0.5$  sec.T2 :  $0.5 \pm 0.1$  sec.

## 13. Central door lock / unlock.

Input	Door lock output
RKE TX	Lock / Unlock
Driver key switch or passenger key switch	↑
Main door lock / unlock switch	↑
Driver/passenger door knob	↑

## 14. 2-Turn unlock

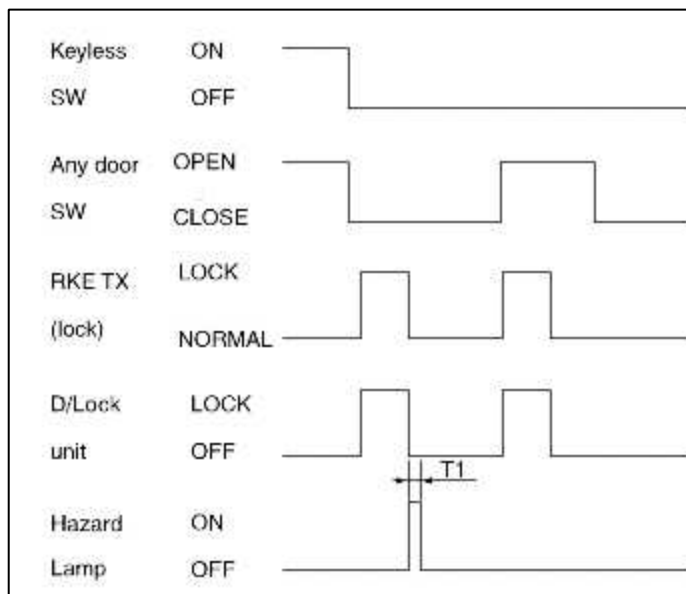


Time specification

 $T_1 : 3 \pm 0.5 \text{ sec.}$  $T_2 : 0.5 \pm 0.1 \text{ sec.}$ 

## 15. Remote keyless Entry system.

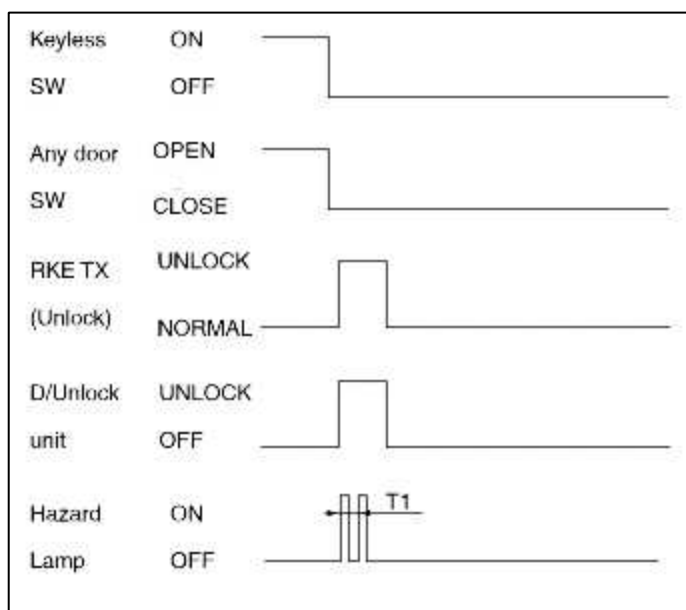
## (1) Door lock



Time specification

 $T_1 : 1.0 \text{ sec.}$ 

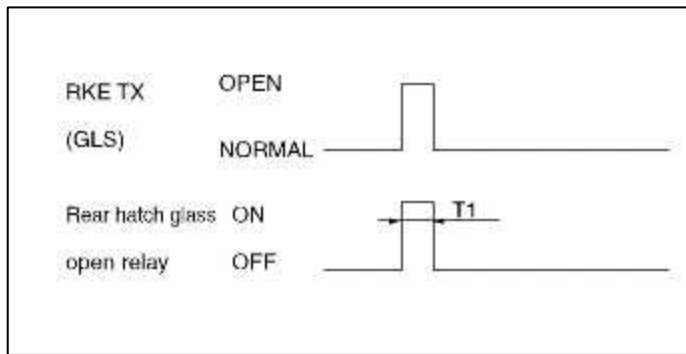
## (2) Door unlock.



Time specification

 $T_1 : 0.5 \text{ sec.}$

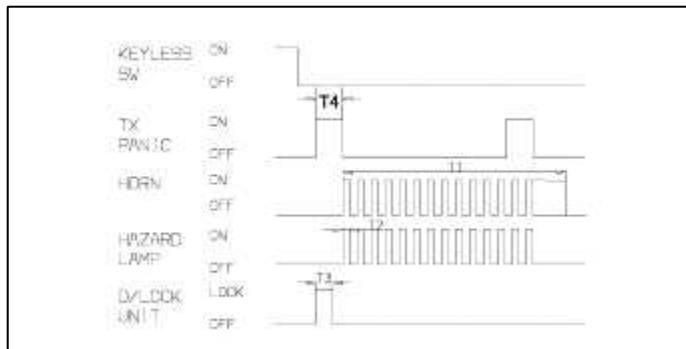
## (3) Rear hatch glass open



Time specification

T1 : 0.5 sec.

## (4) Panic



Time specification

T1 :  $27 \pm 2$  sec.

T2 :  $0.5 \pm 0.1$  sec.

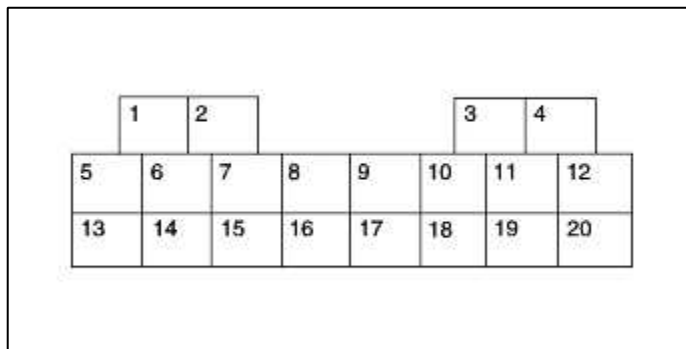
T3 :  $0.5 \pm 0.1$  sec.

T4 :  $2.7 \pm 0.5$  sec.

## 16. Code saving method

Receiver (ETACS module) can save maximum two codes from the transmitter.

(1) Apply the battery voltage to the terminal "6" of DLC (Data Link Connector).



(2) Turn the ignition switch to "ON" position.

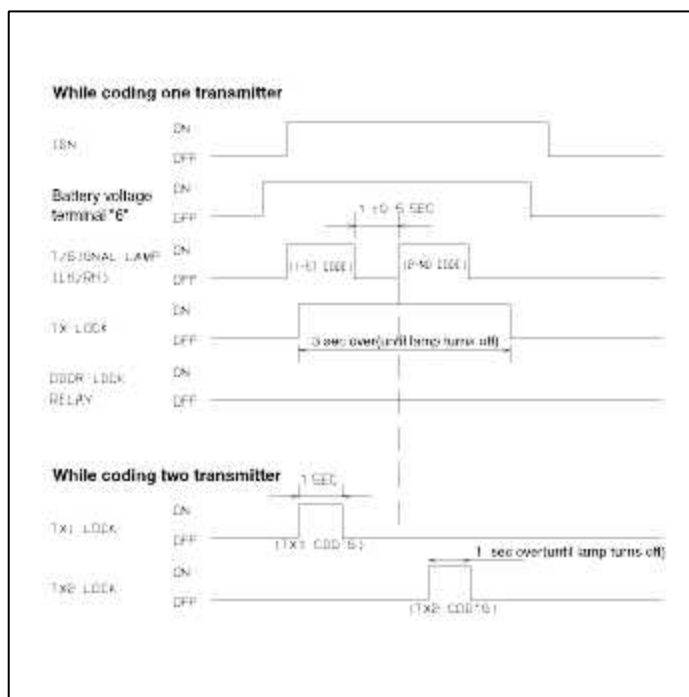
(3) While coding one transmitter.

Press the lock button of transmitter for 3 seconds over until the turn signal lamp turns off.

(4) While coding two transmitters.

Press the lock button of one for 1 second while the turn signal lamp turns on, and then press the lock button of the other for 1 second over until the turn signal lamp turns off.

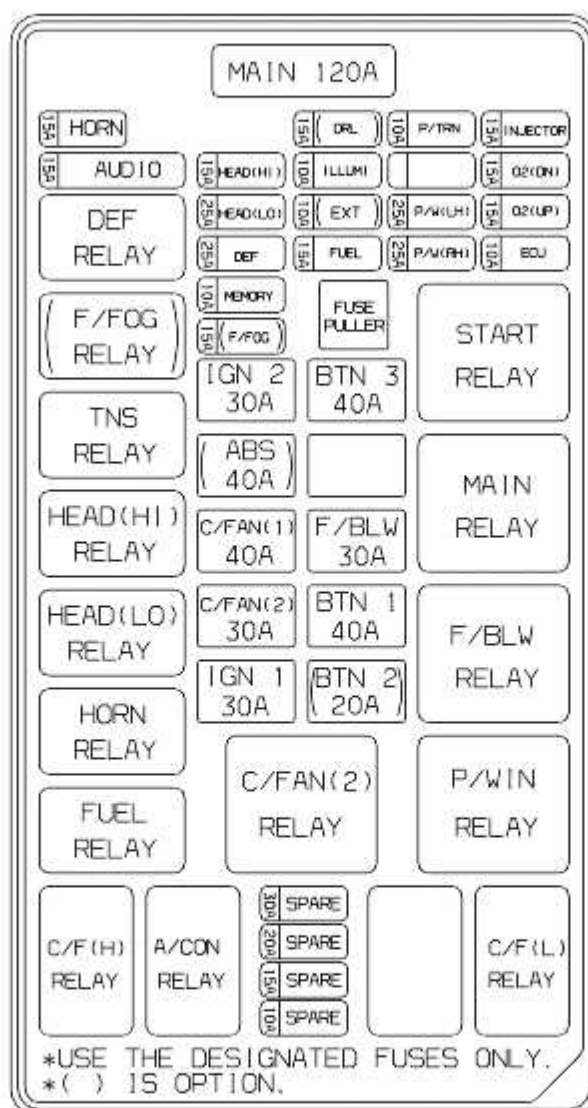
(5) Remove the battery voltage, and then the transmitter code is re-saved on the receiver.



(6) Check the operation of the keyless entry system.

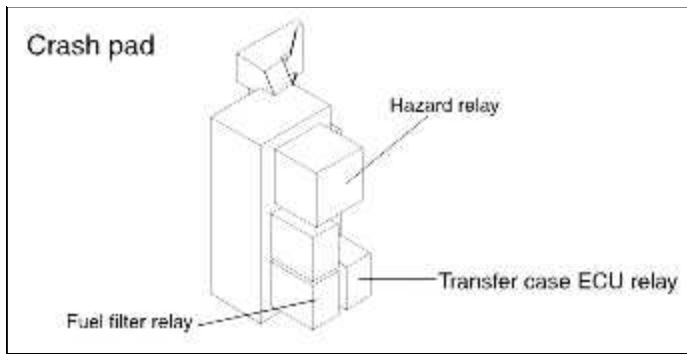
## Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Schematic Diagrams

### COMPONENTS



RELAY

COMPONENTS



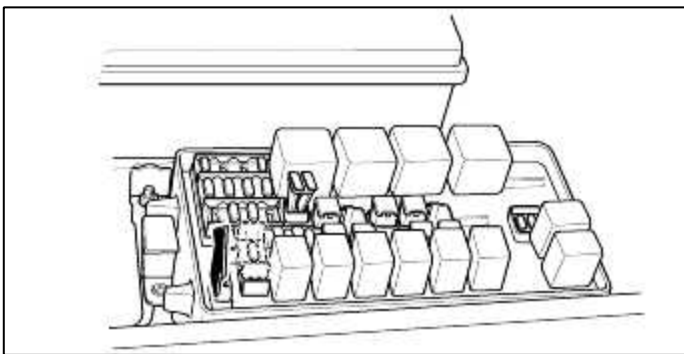
## Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

### INSPECTION

1. Check for a burnt fuse with an ohmmeter.
2. If a fuse burns out, there is a short or some other problem in the circuit. Carefully determine the cause and correct it before replacing the fuse.

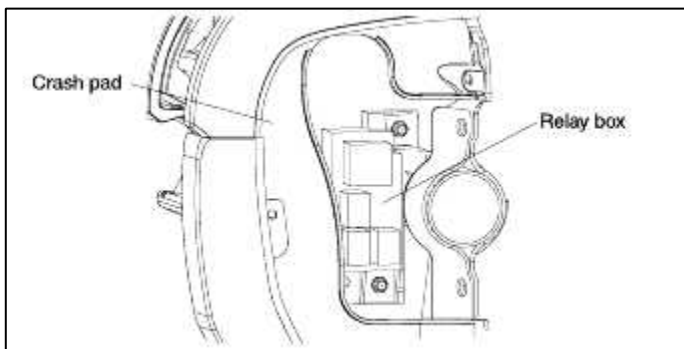
#### CAUTION

The fuse will burn out within 15 seconds if a higher than specified current flows through the circuit.



### INSPECTION

1. Check for a burnt relay with an ohmmeter.
2. If a relay burns out, there is a short or some other problem in the circuit. Carefully determine the cause and correct it before replacing the relay.



## Body Electrical System > Fuses And Relays > Fuses > Schematic Diagrams

### COMPONENTS



1	W/SHD 15A	2	S/ROOF 20A	3	START 10A
4	HAZARD 15A	5	CIGAR(RR) 15A	6	CIGAR(FRT) 15A
7	OBD-11 10A	8	WIPER(FRT) 20A	9	P/SCK 30A
10	RELAY COIL 10A	11	WIPER(RR) 10A	12	ACC 10A
13	TCCS 20A	14	FOG(RR) 15A	15	O/S MIRROR 10A
16	ROOM LAMP 10A	17	S/WARMER 20A	18	PREMIUM AUDIO 30A
19	STOP LAMP 20A	20	TURN LAMP 10A	21	A/BAG 10A
22	METER 10A	23		24	ENGINE 10A

\* USE THE DESIGNATED FUSES ONLY.  
\* ( ) IS OPTION.

### Body Electrical System > Fuses And Relays > Fuses > Repair procedures

#### INSPECTION

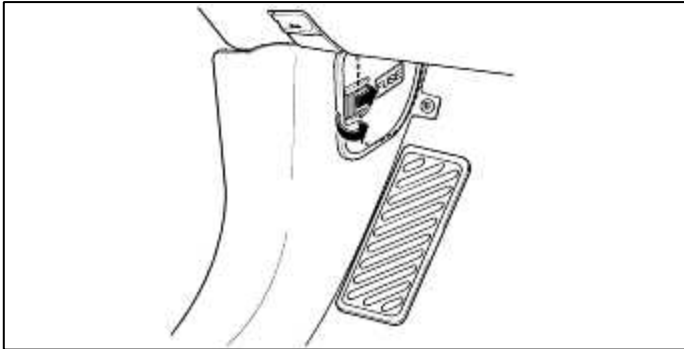
1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?

### 3. Are there any blown fuses?

If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

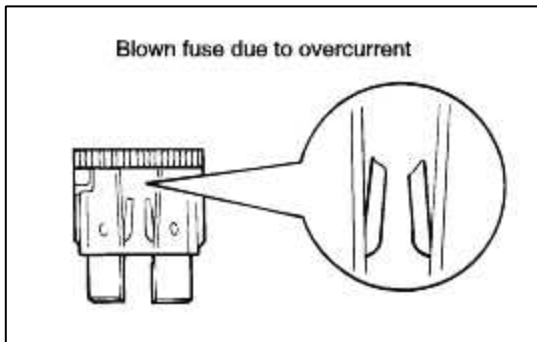
#### CAUTION

Never use a fuse of higher capacity than specified.

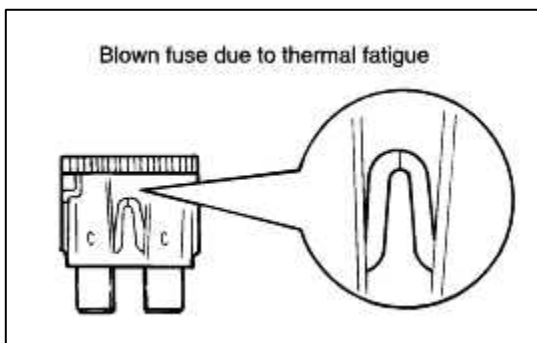


### INSPECTION OF FUSES

1. Prior to replacing the fuse with a new one, check the circuit for a short and the related parts for abnormal conditions. Only after the correction of a short or replacement of abnormal parts, should a fuse with the same ampererating be installed.

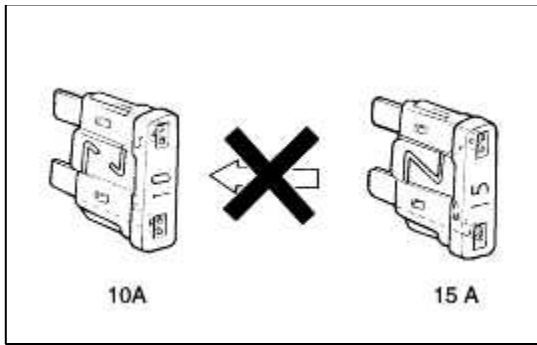


Normally, this type of problem occurs after a fairly long period of use, and is less frequent than #1 above. In this case, you may simply replace with a new fuse of the same capacity.



#### CAUTION

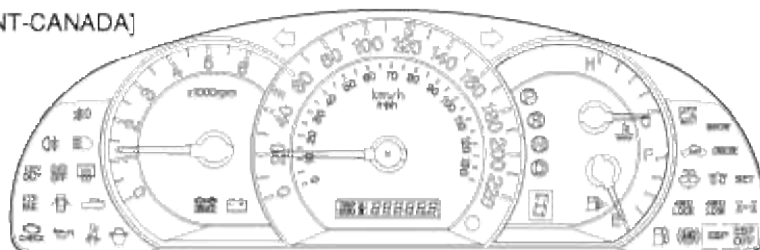
A blade type fuse is identified by the numbered value in amperes. If the fuse is blown, be sure to replace a fuse with the same ampere rating. If a fuse of higher capacity than specified is used, parts may be damaged and a danger of fire exists. To remove or insert a fuse, use the fuse puller in the fuse box.



**Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location**

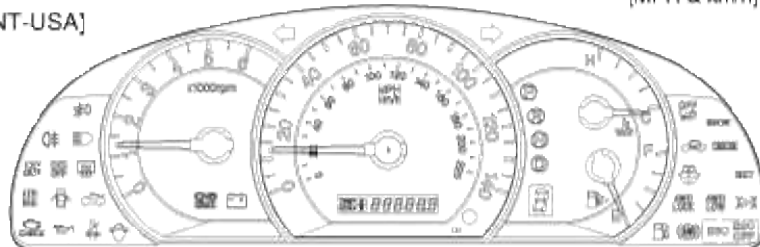
**COMPONENTS**

[FRONT-CANADA]



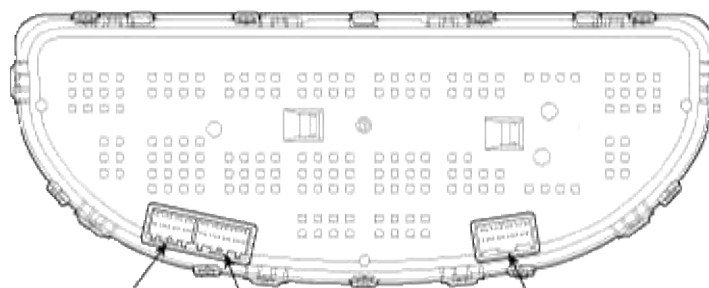
[MPH &amp; km/h]

[FRONT-USA]



[MPH &amp; km/h]

[REAR]



B Connector (16P)

A Connector (20P)

C Connector (20P)

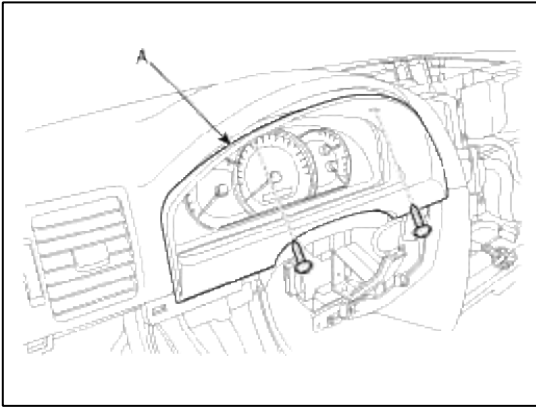
Connector A		Connector B		Connector C	
NO.	CONNECTION	NO.	CONNECTION	NO.	CONNECTION
1	I3+	1	CHECK ENGINE	1	SNOW
2	TEMP INPUT	2	WATER SEPARATOR	2	PAB
3	FUEL INPUT	3	O/D OFF	3	CRUISE
4	FUEL GND	4	TRUNK OPEN	4	4WD LOW
5	ILL (-)	5	Rr-FOG	5	4WD
6	ILL (+)	6	HIGH BEAM GND	6	ESC
7	-	7	HIGH BEAM INPUT (+)	7	ESC OFF
8	OVER SPEED WARN'G	8	FRONT FOG	8	SET
9	-	9	CHARGE	9	VAS OUT
10	-	10	PARKING BRAKE	10	TURN-R
11	B+	11	SEAT BELT	11	-
12	TURN-L	12	OIL PRESSURE	12	4WD LOCK
13	SIGNAL GND	13	AIR BAG SUPPLY(+)	13	ABS
14	TACHO INPUT	14	AIR BAG INPUT	14	WASHER LOW
15	SPEED INPUT	15	DOOR OPEN	15	IMMO
16	4P OUT	16	Rr-DEF	16	D
17	-			17	N
18	KEY OUT (PIC)			18	R
19	PWM SIGNAL			19	P
20	EBD			20	POWER GND

## Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

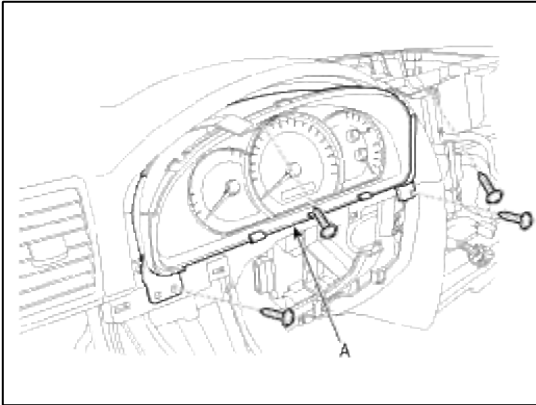
### REMOVAL

1. Disconnect the negative (-) battery terminal.

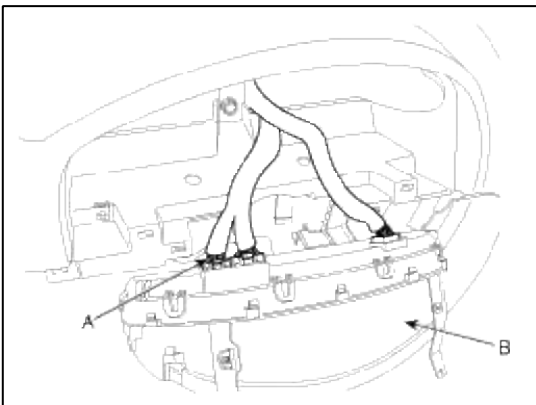
2. Remove the cluster fascia panel (A) after loosening 2 screws (Refer to Body group - Crash pad)



3. Pull out the cluster (A) from the housing after removing 4 screws.



4. Disconnect the cluster connector (A) and then remove the cluster (B).



## INSTALLATION

1. Reassemble the cluster after connecting the cluster connector.
2. Reassemble the cluster housing.
3. Reassemble the cluster fascia panel.

## INSPECTION

### SPEEDOMETER

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks as appropriate.

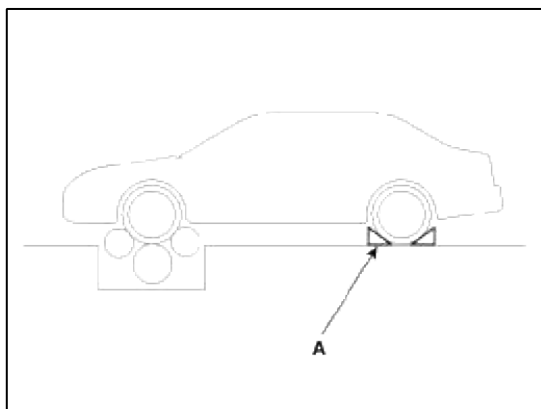
### 3. Check if the speedometer indicator range is within the standard values.

#### CAUTION

Do not operate the clutch suddenly or increase/ decrease speed rapidly while testing.

#### NOTE

Tire wear and tire over or under inflation will increase the indication error.



#### [KM/H-CANADA]

Velocity (km/h)	20	40	60	80	100	120
Tolerance (km/h)	+4 +0.5	+4.5 +1.0	+5.0 +1.0	+5.5 +1.5	+6.0 +2.0	+6.5 +2.5
Velocity (km/h)	140	160	180	200	220	-
Tolerance (km/h)	+7.5 +2.5	+8.0 +3.0	+9.5 +4.5	+10.5 +5.5	+11 +6	-

#### [MPH-USA]

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	+2.8 +0.3	+3.0 +0.5	+3.8 +3.0	+4.0 +1.0
Velocity (MPH)	80	100	120	140
Tolerance (MPH)	+4.5 +1.5	+5.5 +2.5	+6.5 +2.5	+7.0 +3.0

## TACHOMETER

1. Connect the scan tool to the diagnostic link connector or install a tachometer.

2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

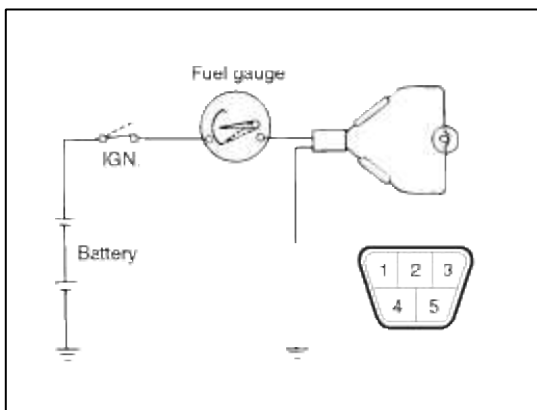
**CAUTION**

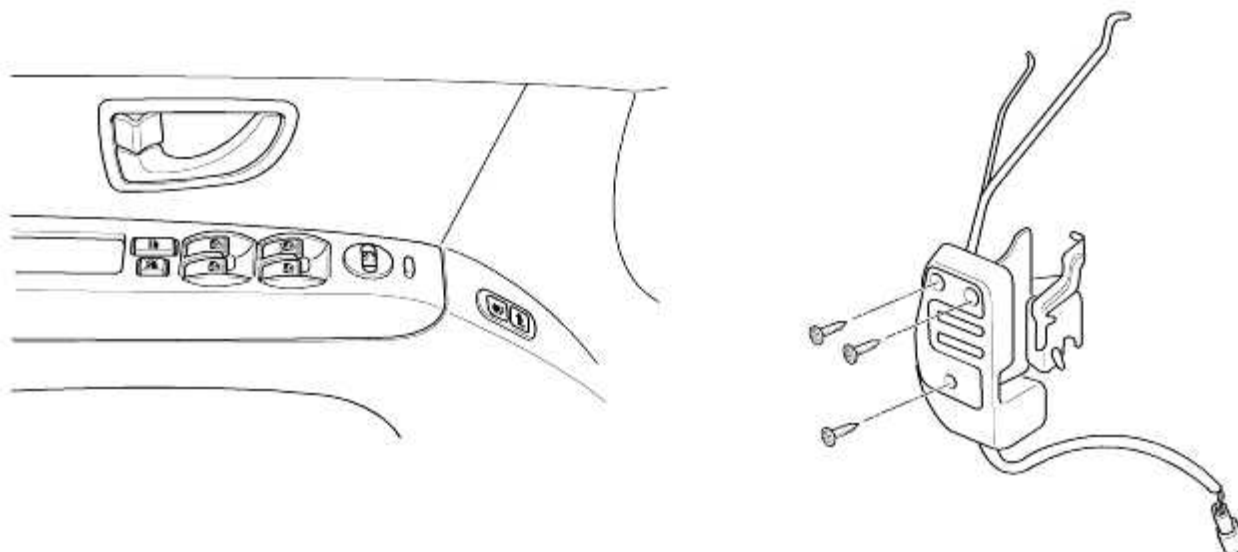
- Reversing the connections of the tachometer will damage the transistor and diodes inside.
- When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution (rpm)	1,000	2,000	3,000	4,000	Engine
Tolerance (rpm)	±100	±125	±150	±150	Gasoline
Revolution (rpm)	5,000	6,000	7,000	8,000	Engine
Tolerance (rpm)	±150	±180	±210	-	Gasoline

**FUEL GAUGE**

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 wattages, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.

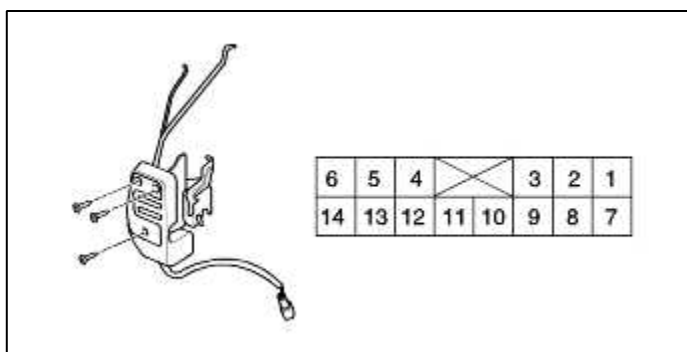

**Body Electrical System > Power Door Locks > Power Door Lock > Components and Components Location**
**COMPONENTS**



### Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

#### INSPECTION

1. Disconnect the actuator connector from the wiring harness.
2. Apply battery voltage (12V) to each terminal as shown in the table and verify that the actuator operates correctly.



Terminal \ Position	3	12	10
Open	+	—	—
Close	—	+	—

### Body Electrical System > Power Door Mirrors > Power out side mirror switch > Repair procedures

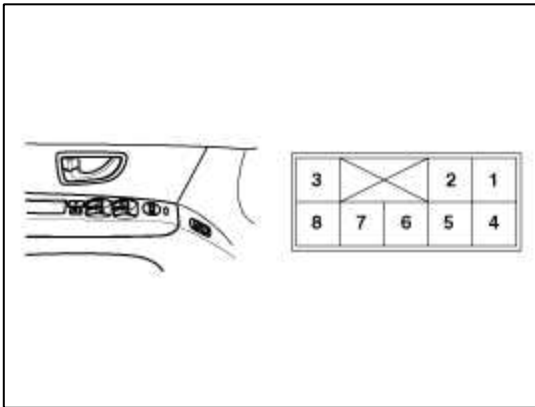
#### INSPECTION

1. Remove the power door mirror switch from the door trim panel.



2. Check for continuity between the terminals in each switch position according to the table.

If continuity is not as specified, replace the power door mirror switch.

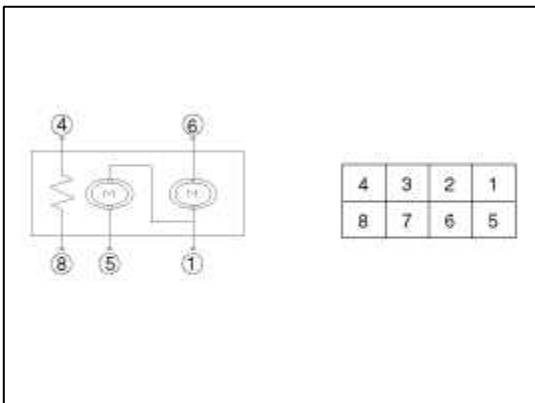


Terminal Position		8	4	7	6	5	2	3
LH Side	UP							
	DOWN							
	OFF							
	LEFT							
	RIGHT							
RH Side	UP							
	DOWN							
	OFF							
	LEFT							
	RIGHT							

### Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

#### INSPECTION

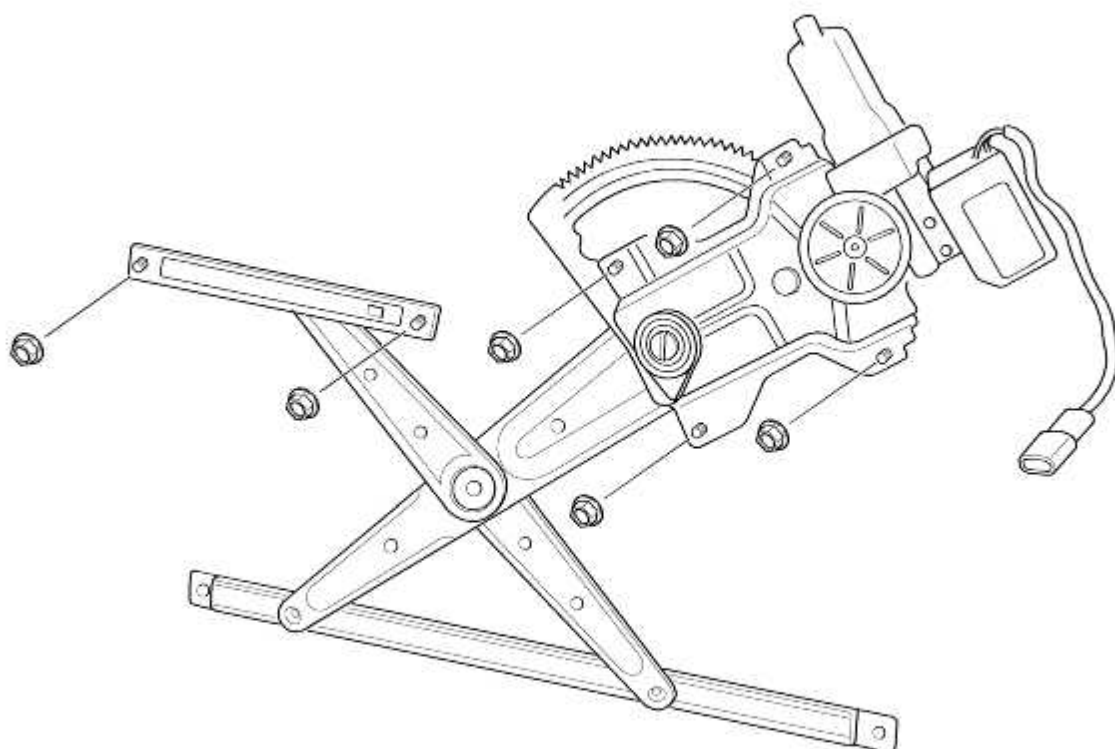
1. Disconnect the power door mirror connector from the harness.
2. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



Terminal Position		①	②	①	②	③	+	-
LH Side	UP	○	○			○	○	○
	DOWN	○	○			○	○	○
	OFF	○	○				○	
	RIGHT	○	○			○	○	○
	LEFT	○	○			○	○	○
RH Side	UP			○	○	○	○	○
	DOWN			○	○	○	○	○
	OFF			○	○		○	
	RIGHT			○	○	○	○	○
	LEFT			○	○	○	○	○

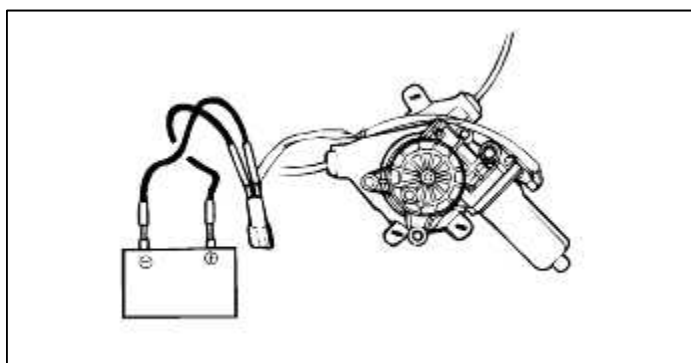
**Body Electrical System > Power Windows > Power Window Motor > Components and Components Location**

## COMPONENTS



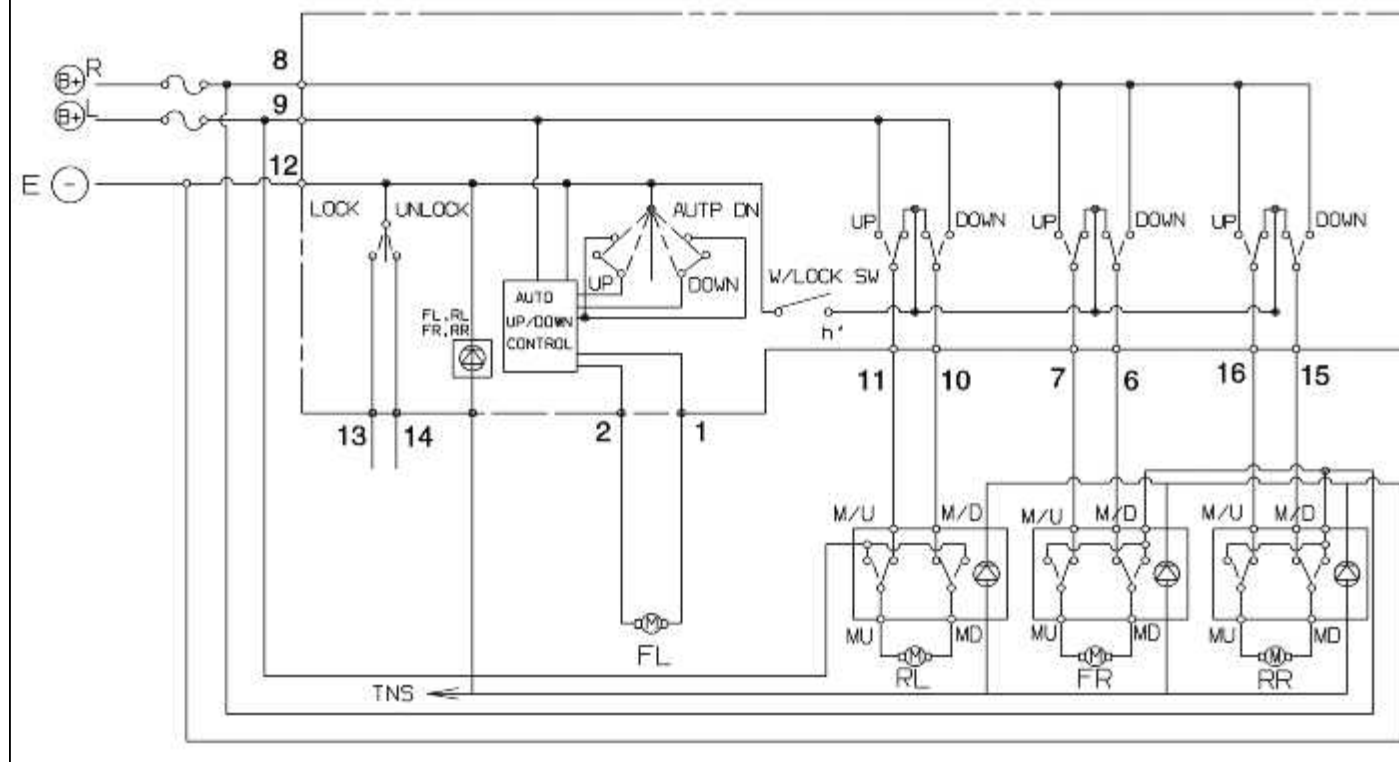
**Body Electrical System > Power Windows > Power Window Motor > Repair procedures**

**INSPECTION**



**Body Electrical System > Power Windows > Power Window Switch > Schematic Diagrams**

**CIRCUIT DIAGRAM**



## Body Electrical System > Power Windows > Power Window Switch > Repair procedures

### INSPECTION

#### POWER WINDOW MAIN SWITCH

1. Remove the switch from the door trim panel.
2. Check for continuity between the terminals. If continuity is not as specified in the table, replace the power window switch.

S/W TER POSITION	POWER WINDOW SWITCH															
	FL				FR				RL				RR			
	9	2	1	12	7	8	6	12	11	9	10	12	16	8	15	12
UP	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
OFF	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DOWN	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
AUTO DOWN	○	○	○	○												

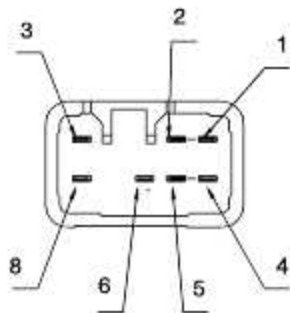
8	7	6	5	4	3	2	1
16	15	14	13	12	11	10	9

#### DOOR LOCK SWITCH

Terminal Position	13	14	12
LOCK			
OFF			
UNLOCK			

### POWER WINDOW SUB SWITCH

TERMI- NAL PO- SITION	POWER WINDOW S/W						
	6	2	5	3	8	1	4
U P							
OFF							
DOWN							



### INSPECTION






#### POWER WINDOW MAIN SWITCH

1. Remove the switch from the door trim panel.
2. Check for continuity between the terminals. If continuity is not as specified in the table, replace the power window switch.
















S/W TER- MINAL POSITION	POWER WINDOW SWITCH															
	FL				FR				RL				RR			
	9	2	1	12	7	8	6	12	11	9	10	12	16	8	15	12
UP																
OFF																
DOWN																
AUTO DOWN																

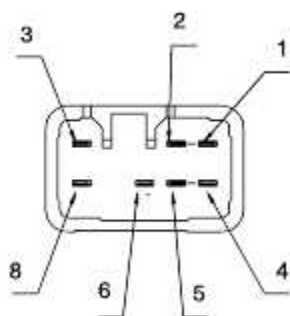
8	7	6	5	4	3	2	1
16	15	14	13	12	11	10	9

### DOOR LOCK SWITCH

Terminal Position	13	14	12
LOCK			
OFF			
UNLOCK			

### POWER WINDOW SUB SWITCH

TERMI- PO- SITION	POWER WINDOW S/W						
	6	2	5	3	8	1	4
U P							
OFF							
DOWN							

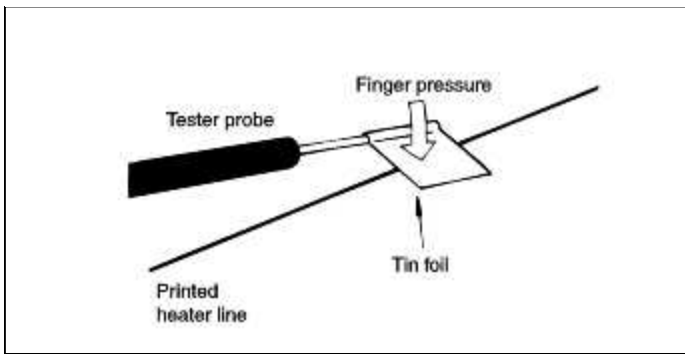


## Body Electrical System > Rear Window Defogger > Rear Window Defogger Printed Heater > Repair procedures

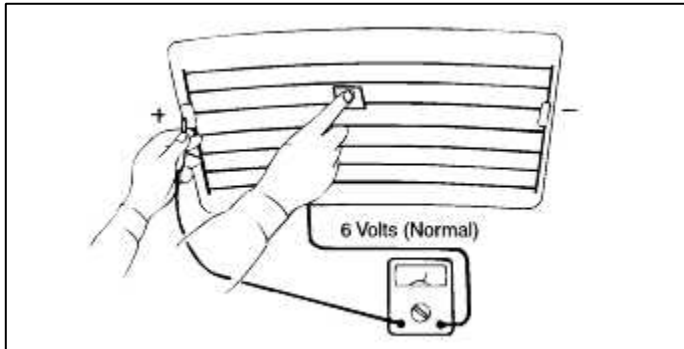
### INSPECTION

#### CAUTION

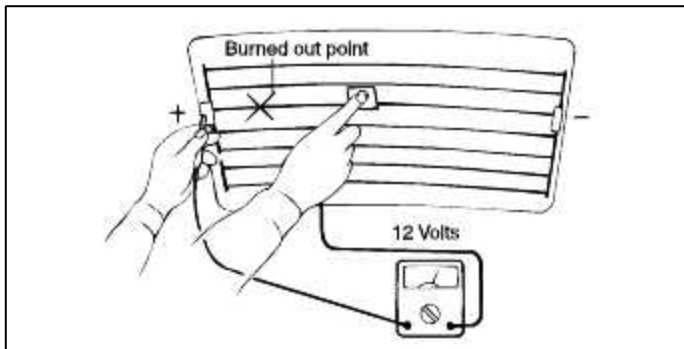
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



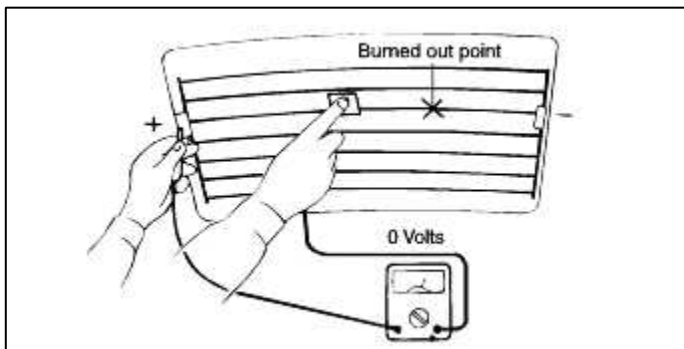
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



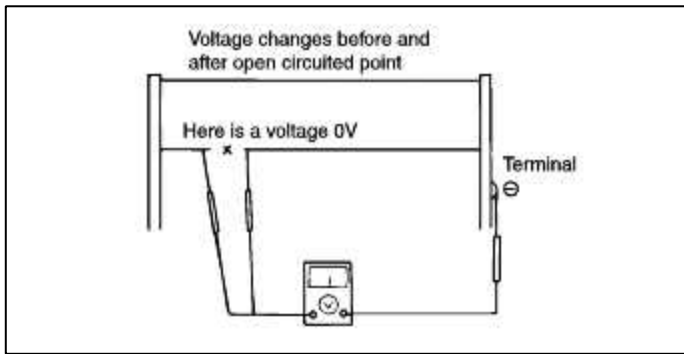
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



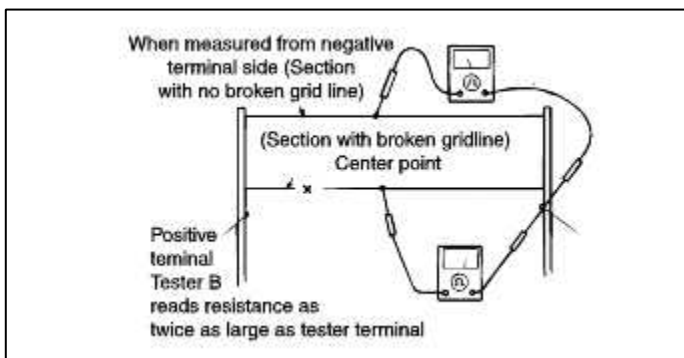
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.



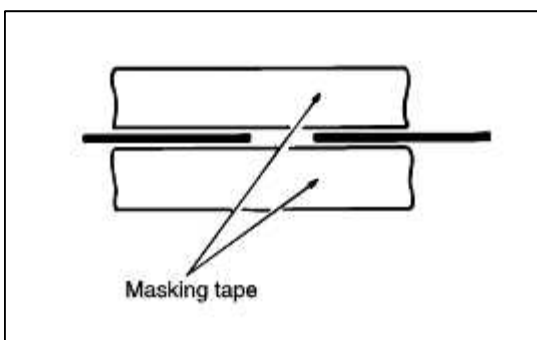
#### REPAIR OF BROKEN HEATER LINE

1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Thin brush.

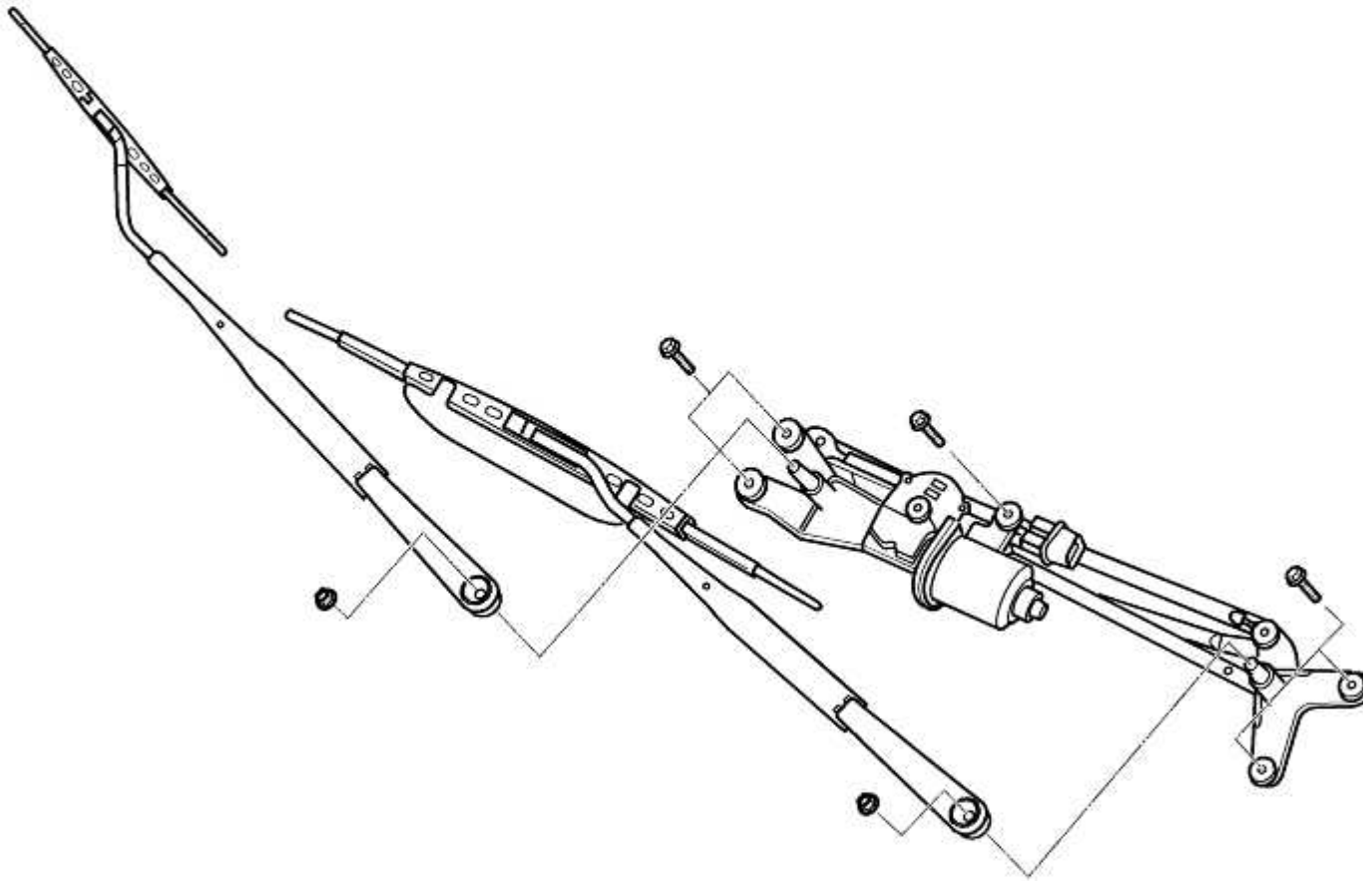
Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (allow 24 hours).

#### CAUTION

After repairing, clean the glass with a soft dry cloth or wipe along the grid line with a slightly moistened cloth.



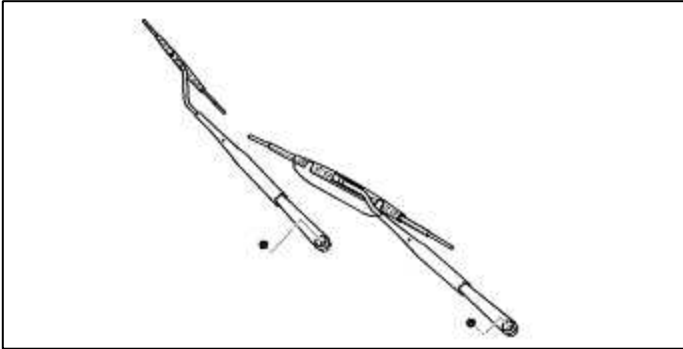


**Body Electrical System > Windshield Wiper/Washer > Components and Components Location****COMPONENTS****Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures****REMOVAL**

1. Remove the windshield wiper arm and blade after removing the 2 nuts.

**NOTE**

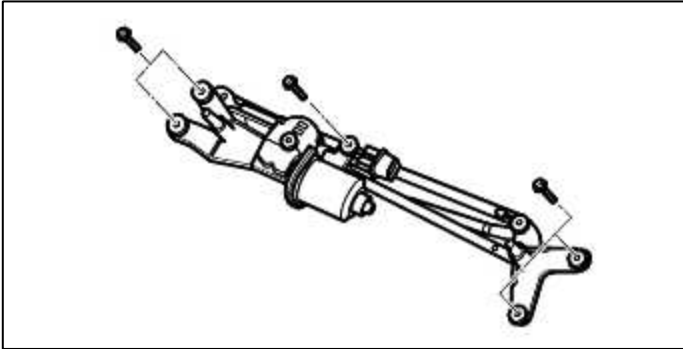
Care must be taken not to scratch the engine hood.



Tightening torque :

19-28Nm (190-280kg·cm, 14-20.6lb·ft)

2. Remove the weather strip and the cowl top cover then remove the 5 bolts holding the linkage.



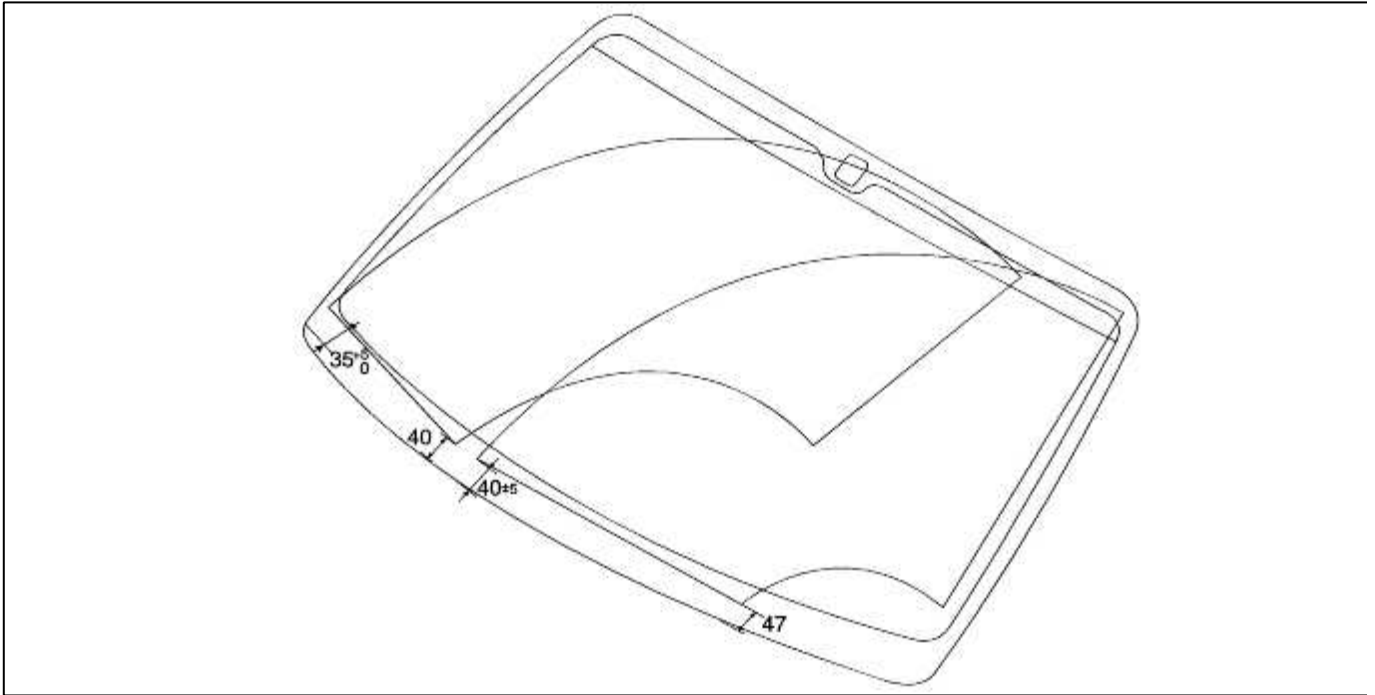
Tightening torque :

4-6Nm (40-60kg·cm, 2.9-4.4lb·ft)

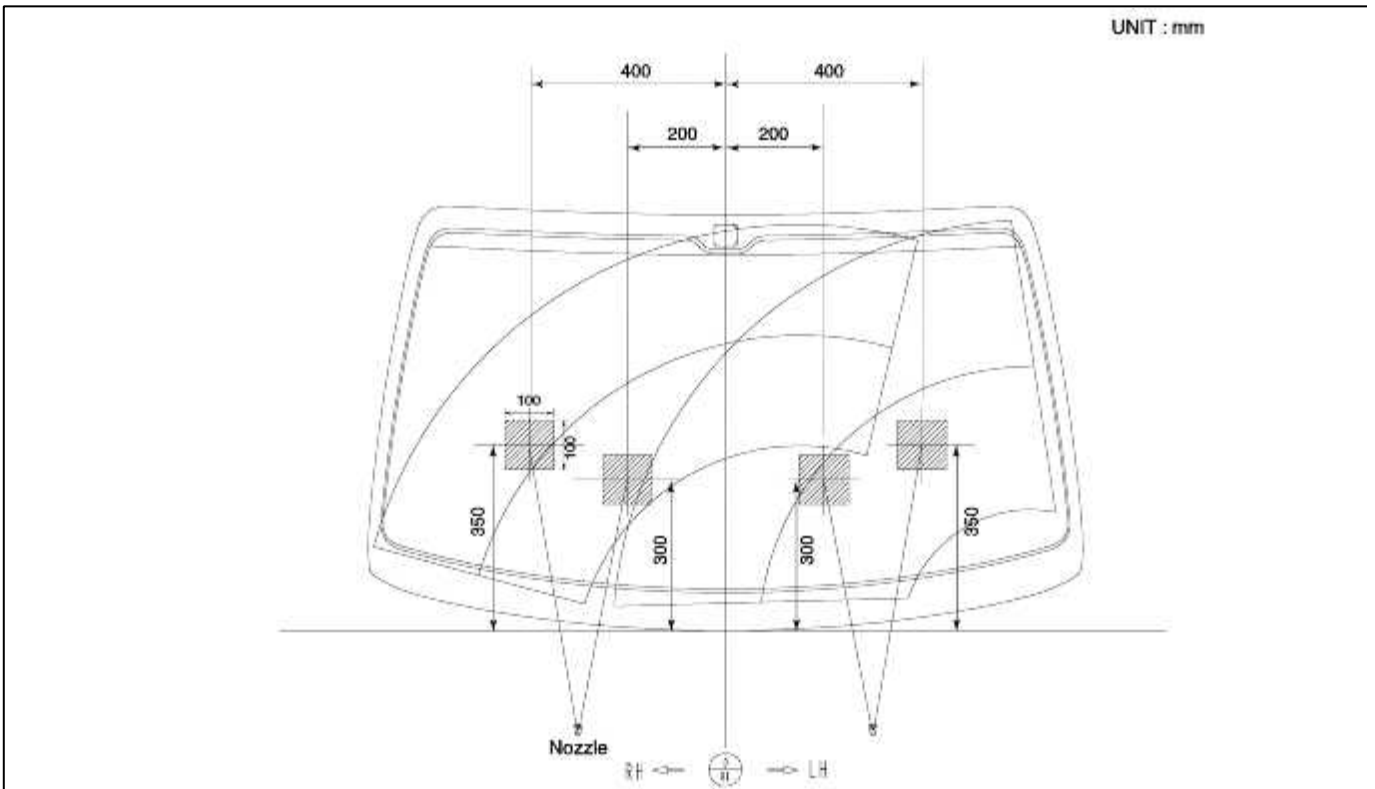
3. Disconnect the windshield wiper motor connector and remove the windshield wiper motor and the linkage.

## INSTALLATION

1. Install the wiper arm to the specified position.



2. Set the washer nozzle on the specified spray position.

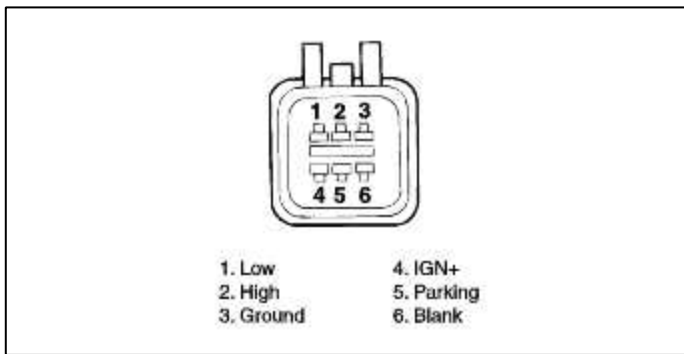


## INSPECTION

### SPEED OPERATION CHECK

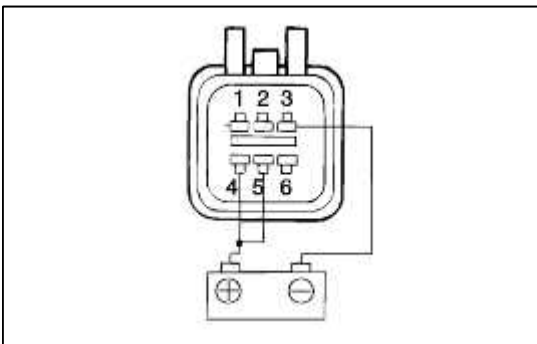
1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 3.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.

5. Check that the motor operates at high speed.



Automatic stop operation check

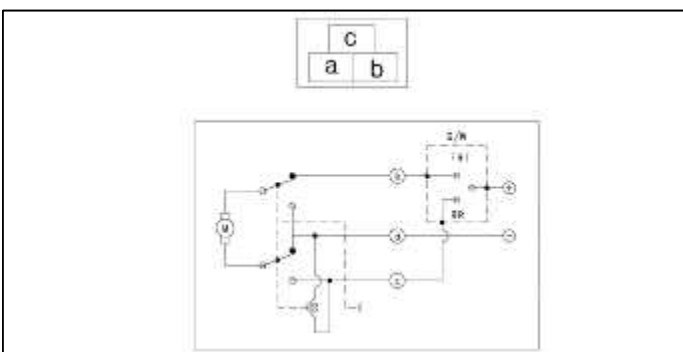
1. Operate the motor at low speed.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 3.
3. Connect terminals 4 and 5.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 3.
5. Check that the motor stops running at the off position.



### Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

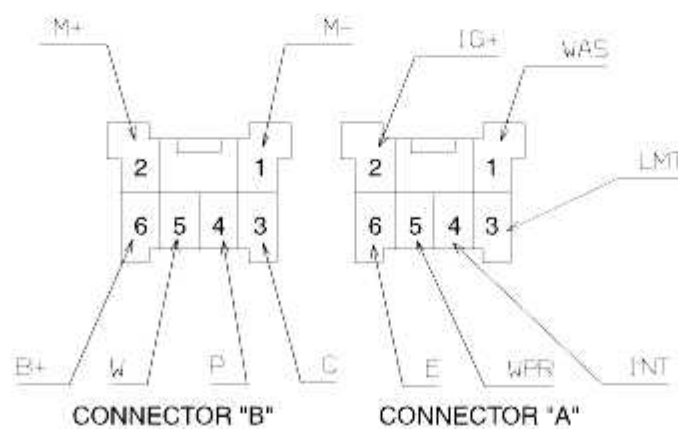
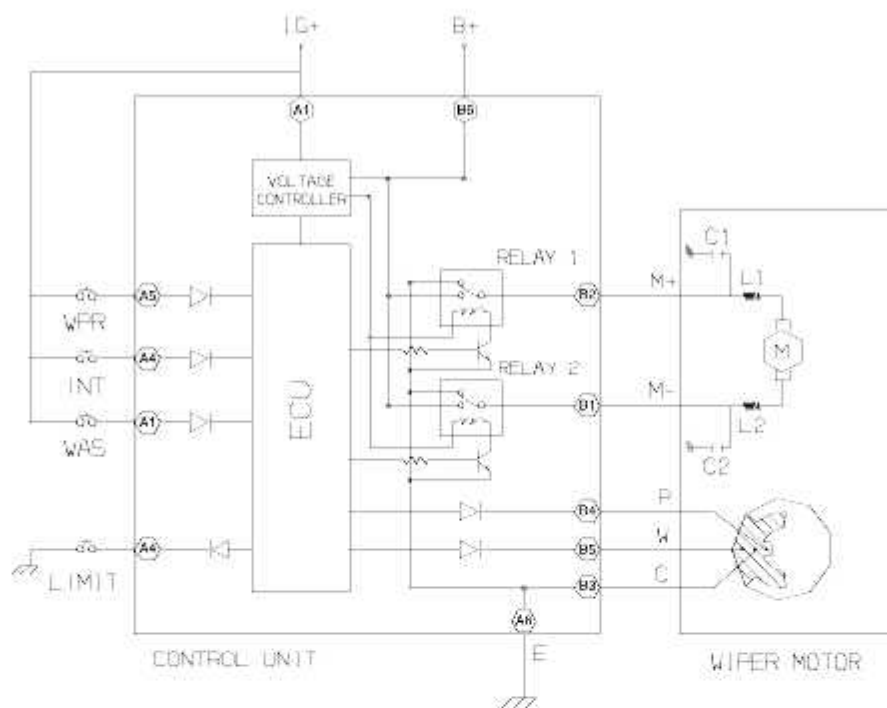
#### INSPECTION

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Apply the battery voltage to the terminal a and ground the terminal b or c to see that the washer motor runs and water sprays from the front or rear nozzles.
3. Check that the motor operates normally.



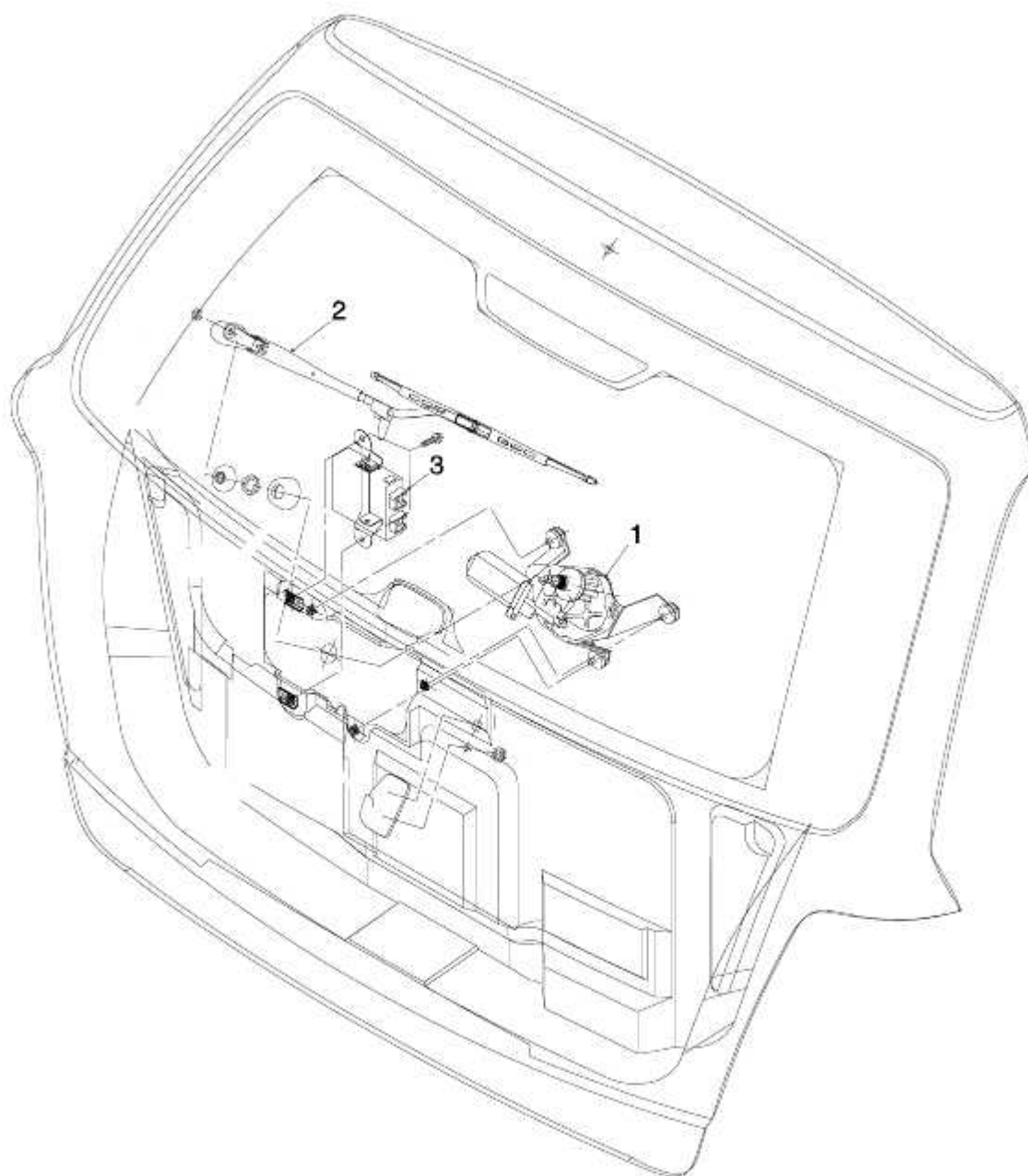
### Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Schematic Diagrams

#### REAR WIPER CONTROL UNIT CIRCUIT



## Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Components and Components Location

### COMPONENTS



1. Rear wiper motor  
2. Rear wiper arm & blade

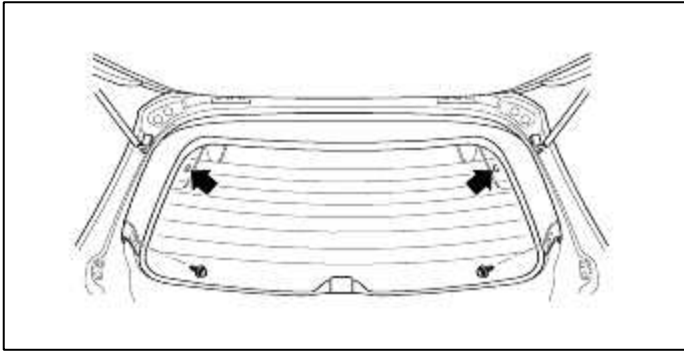
3. Control unit

**Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Repair procedures**

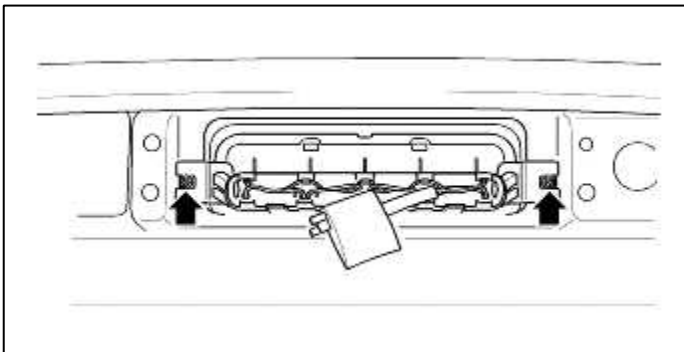
**REMOVAL**

1. Disconnect negative battery cable.

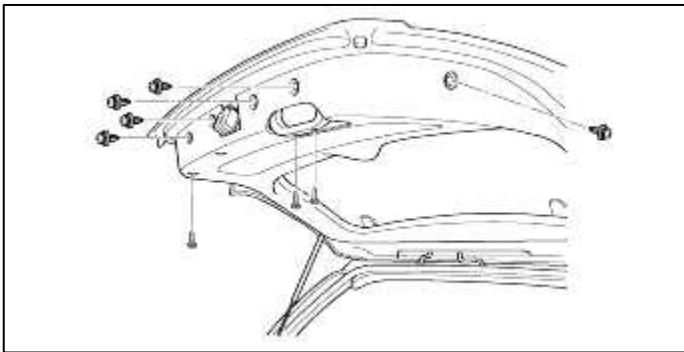
2. Remove Tailgate upper trim.
  - (1) Disconnect rear window defroster connector.
  - (2) Remove upper trim fastener.



3. Remove high-mounted brake light.
  - (1) Disconnect electrical connector.
  - (2) Remove high-mounted brake light screws(2).



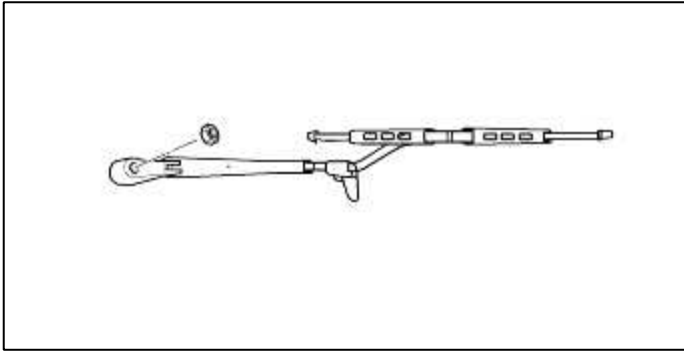
4. Remove tailgate trim.
  - (1) Remove tailgate fasteners(6) and screws(1).



- (2) Remove inner assist handle screws(2).
5. Remove tailgate screen.

6. Remove rear wiper arm and wiper blade.

- (1) Remove head cap.
- (2) Remove wiper blade nut(1).



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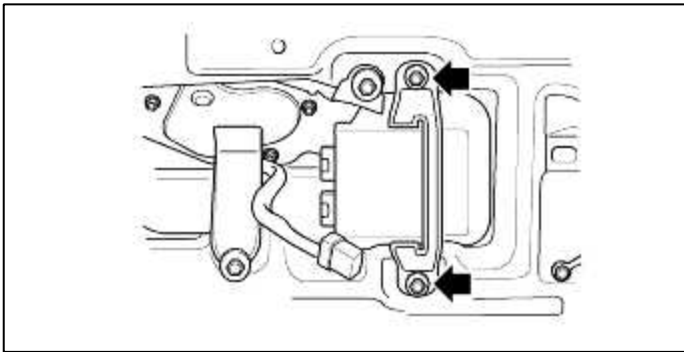
Tightening torque

18 - 22 N·m (1.8-2.2kg-m, 13-16 lb-ft)

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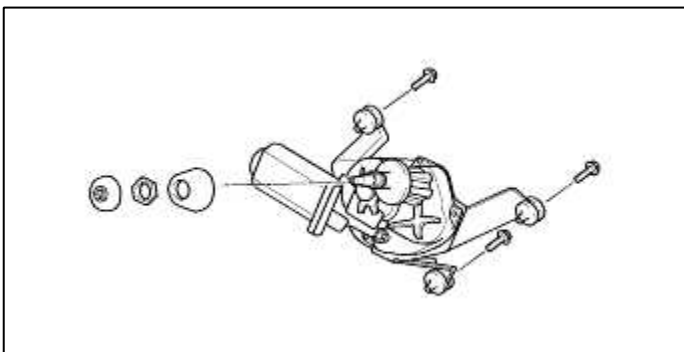
7. Remove rear wiper control unit.

- (1) Disconnect electrical connector.
- (2) Remove wiper control unit bolts(2).



8. Remove rear wiper motor.

- (1) Remove wiper motor cover.
- (2) Remove wiper motor nut.
- (3) Remove wiper motor bolts(3).



---

Tightening torque : nut

3 - 6 N·m (0.3-0.6kg-m, 2-4 lb-ft)

Tightening torque : bolts

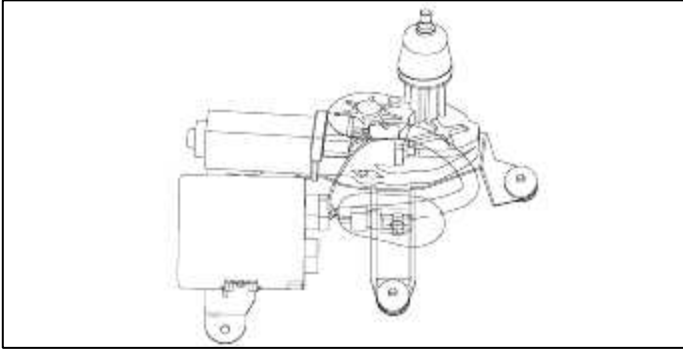
7 - 10 N·m (0.7-1.0 kg-m, 5-7 lb-ft)

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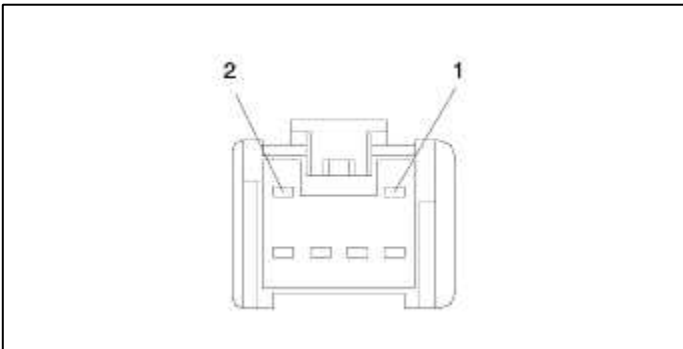


## INSPECTION

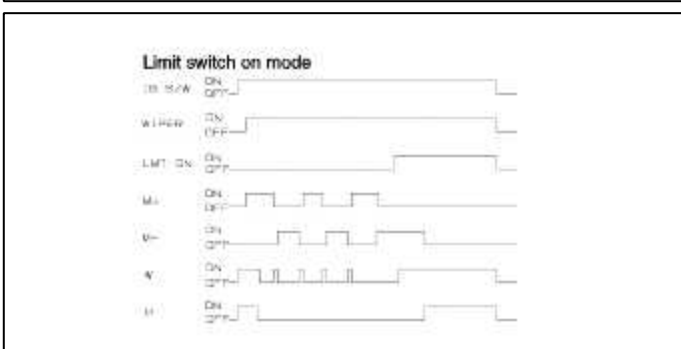
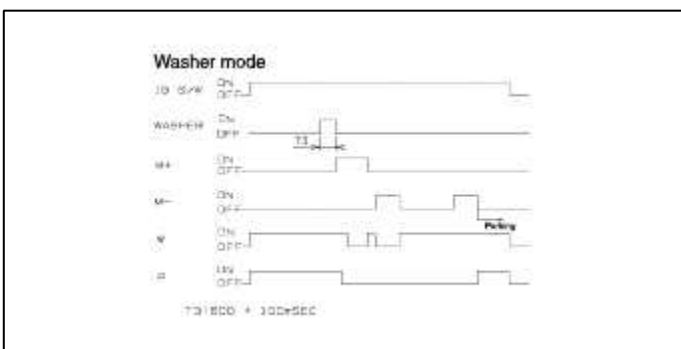
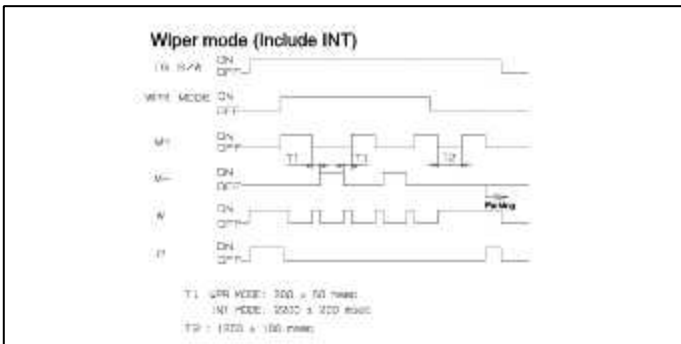
1. Remove the connector from the rear wiper motor.

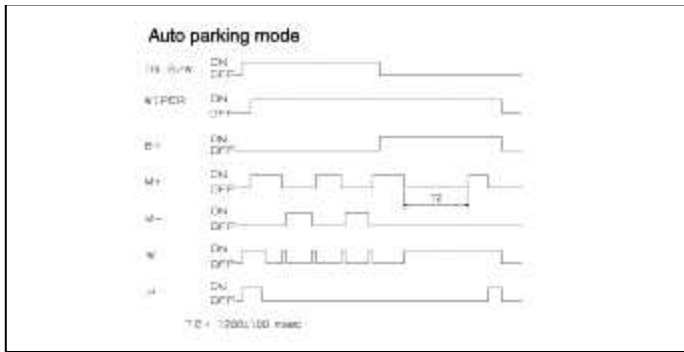


2. Connect battery positive (+) and negative (-) cables to terminals 1 and 2 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.

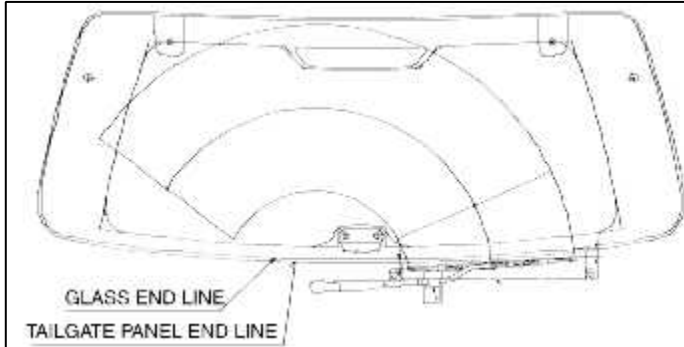


4. Check that the rear wiper operates according to the following time chart.

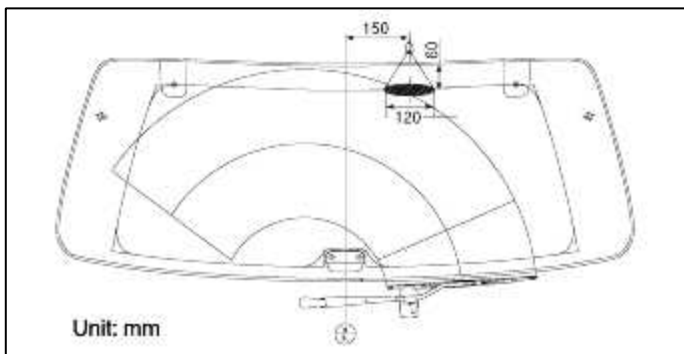




5. After replacing all the removed components, install the rear wiper arm to the specified stop position.

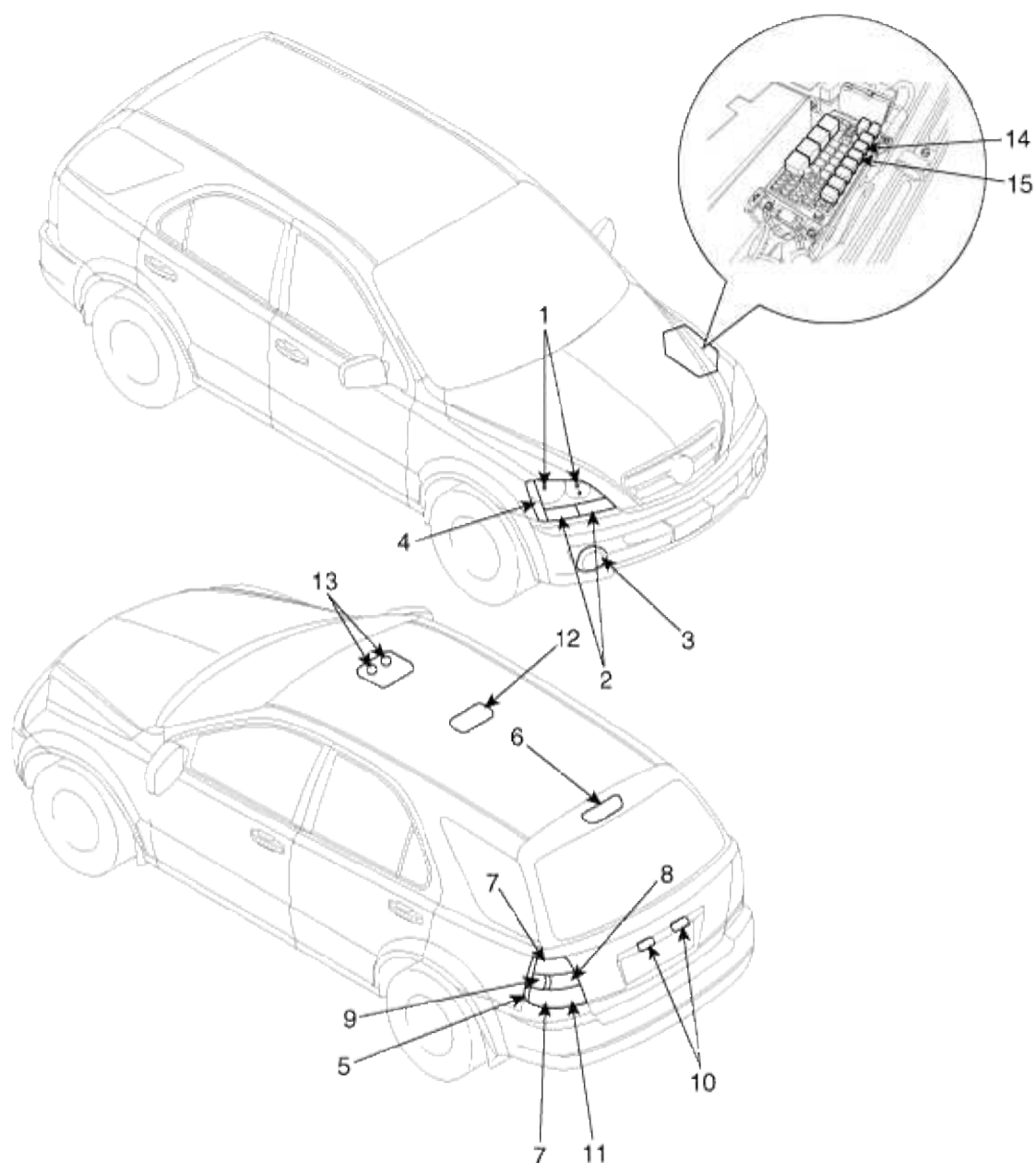


6. Set the washer nozzle on the specified spray position.



## Body Electrical System > Lighting System > Components and Components Location

### COMPONENT LOCATION



1. Head lamp (Low/High)
2. Front turn signal / Position lamp
3. Front fog lamp
4. Side marker
5. Rear side marker
6. High mounted stop lamp
7. Tail lamp
8. Back up lamp

9. Rear turn signal lamp
10. License plate lamp
11. Stop lamp
12. Room lamp
13. Overhead console lamp
14. Head lamp (Low) relay
15. Head lamp (High) relay

## Body Electrical System > Lighting System > Specifications

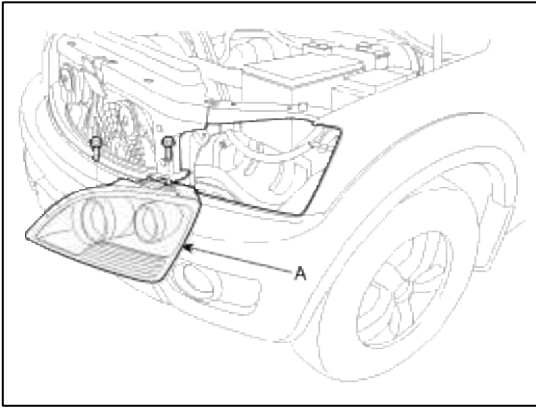
### SPECIFICATION

Items		Bulb Wattage (W)
FRONT	Head lamp (High)	55
	Head lamp (Low)	55
	Front turn signal lamp	28
	Front position lamp	8
	Front fog lamp	27
	Side marker	5
REAR	Rear stop/tail lamp	27/8
	Back up lamp	18
	Rear turn signal lamp	27
	License plate lamp	5
	Rear side marker	5
INTERIOR	Room lamp	10 x 2
	Overhead console lamp	10 x 2
	Luggage lamp	5
	Door courtesy lamp	5

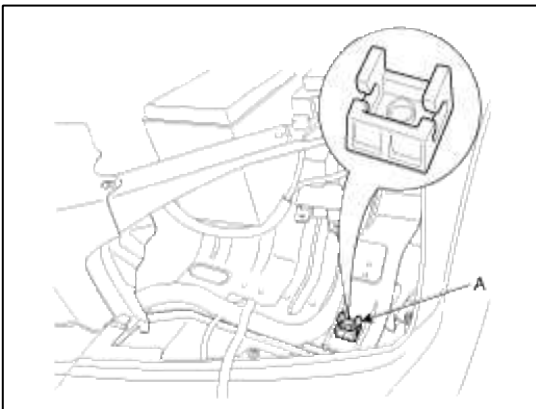
**Body Electrical System > Lighting System > Head Lamps > Repair procedures**
**REMOVAL**

1. Disconnect the negative (-) battery terminal.

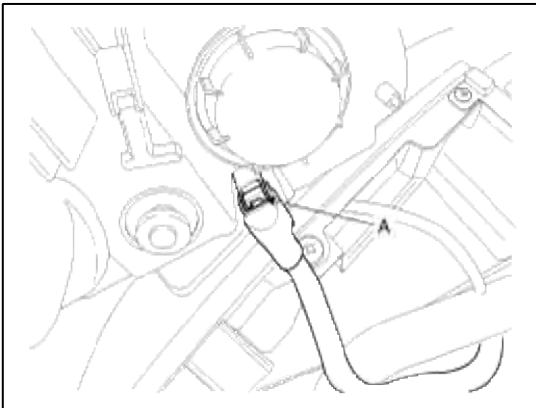
2. Loosen the mounting bolts (3EA). And remove the head lamp assembly (A) after disconnecting the lamp connectors.

**NOTE**

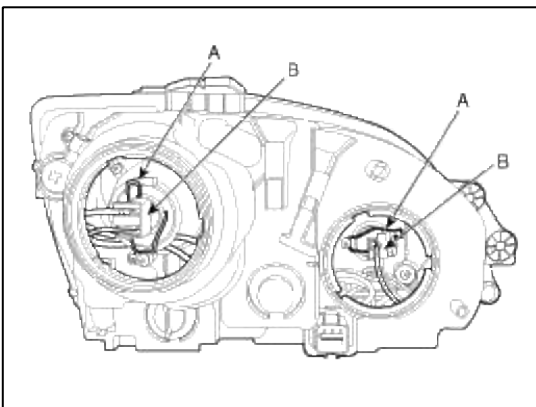
Take care that retaining clip (A) is not to be damaged.



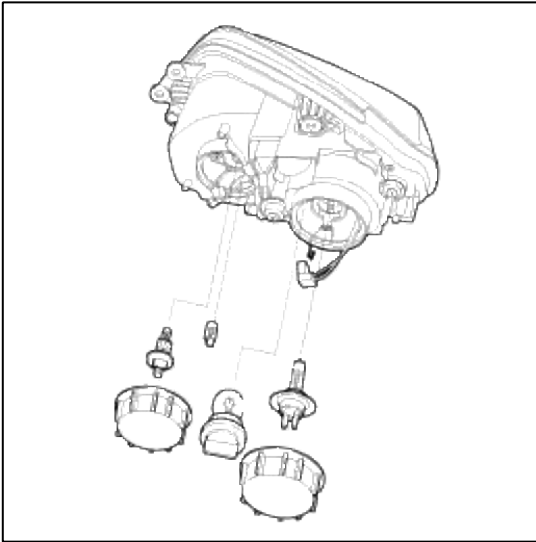
3. Remove the power connector (A) of lamp assembly.



4. Remove the fixing spring (A) and bulb connector (B) after loosening the cover.



### 5. Remove the head lamp bulb.

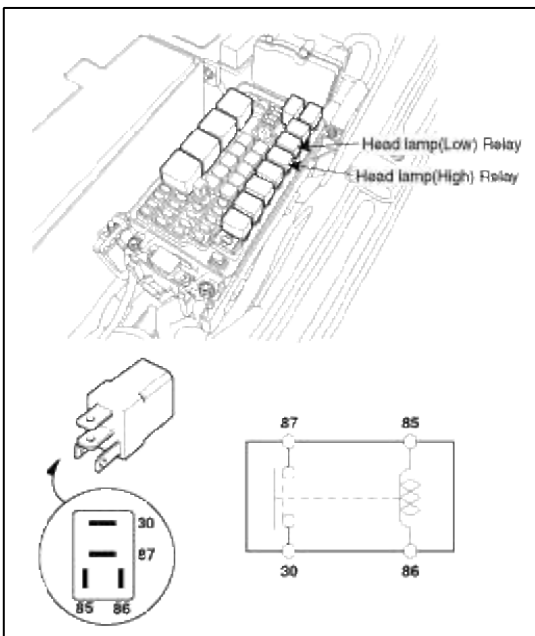


## INSTALLATION

1. Reassemble the head lamp bulb.
2. Connect the bulb connector and fixing spring.
3. Connect the power connector to the lamp assembly
4. Reassemble the head lamp assembly to retaining clip.

## HEAD LAMP RELAY INSPECTION

1. Check for continuity between the terminals of head lamp relay.
2. There should be continuity between the No.86 and No.85 terminals when power and ground are connected to the No.87 and No.30 terminals.
3. There should be continuity between the No.87 and No.30 terminals when power is disconnected.



Terminal	30	87	85	86
Power				
Disconnected			○ — ○	
Connected	○ — ○		○ — ⊕	

## HEAD LAMP AIMING INSTRUCTIONS

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment

manufacturer's instructions.

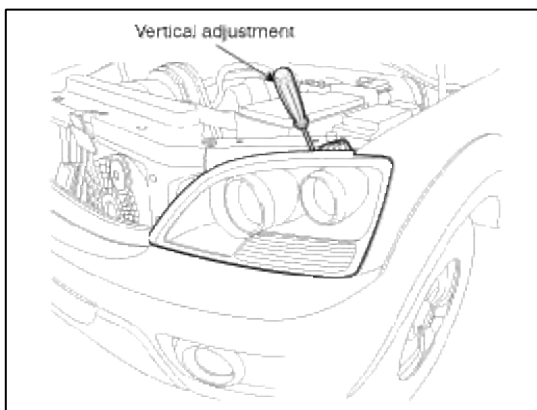
#### NOTE

If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen
4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.

Make vertical adjustments to the lower beam using the adjusting wheel.

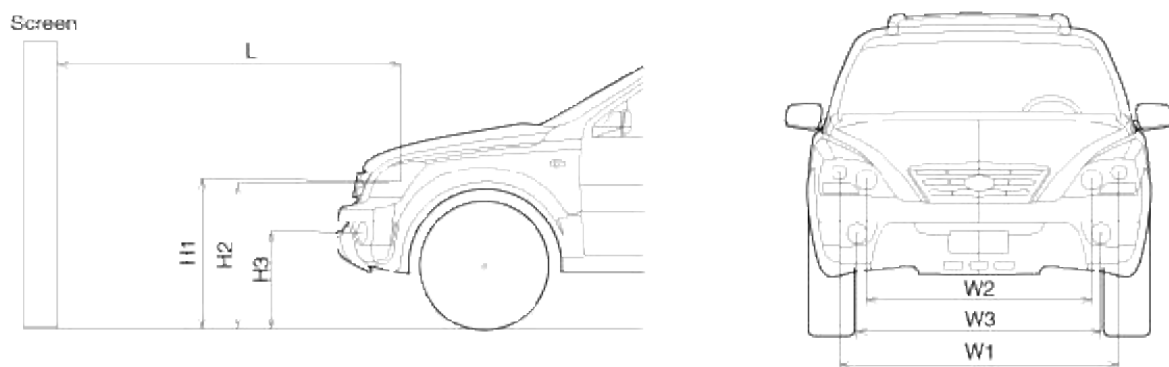


#### FRONT FOG LAMP AIMING

The front fog lamps should be aimed in the same manner as the head lamps aiming.

With the front fog lamps and battery in normal condition, aim the front fog lamps by turning the adjusting gear.

#### HEAD LAMP AND FOG LAMP AIMING POINT



H1 : Height between the head lamp bulb center and ground (Low beam)

H2 : Height between the head lamp bulb center and ground (High beam)

H3 : Height between the fog lamp bulb center and ground

W1 : Distance between the two head lamp bulbs centers (Low beam)

W2 : Distance between the two head lamp bulbs centers (High beam)

W3 : Distance between the two fog lamp bulbs centers

L : Distance between the head lamp bulb center and screen

Unit : in(mm)

Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	35.0(891)	33.4(849)	21.5(546)	58.6(1,490)	47.5(1,207)	51.6(1,310)	118.1(3,000)
With driver	34.6(876)	32.8(834)	20.9(531)				

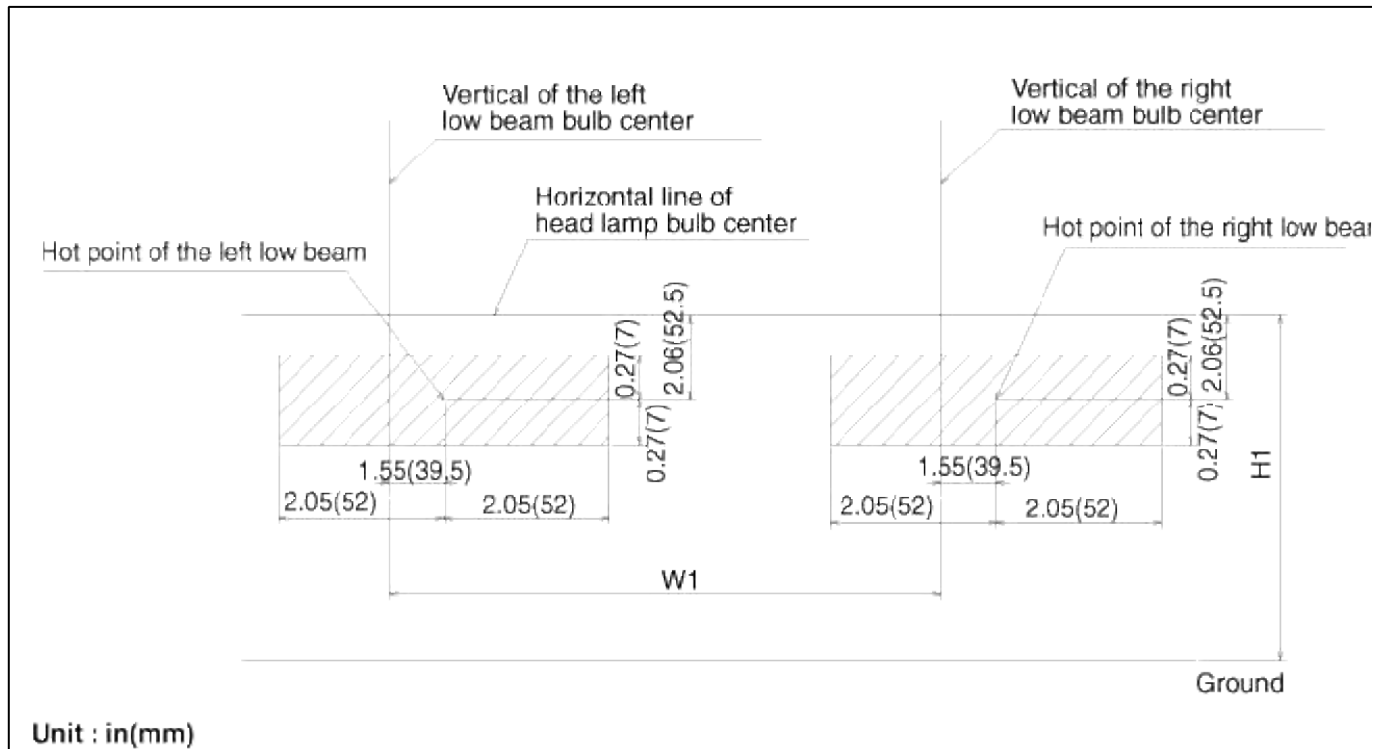
1. Turn the low beam on without the driver aboard.

The cut-off line should be projected in the allowable range (shaded region).

In case of equipping with the manual leveling device, set the leveling device switch on the "O" position.

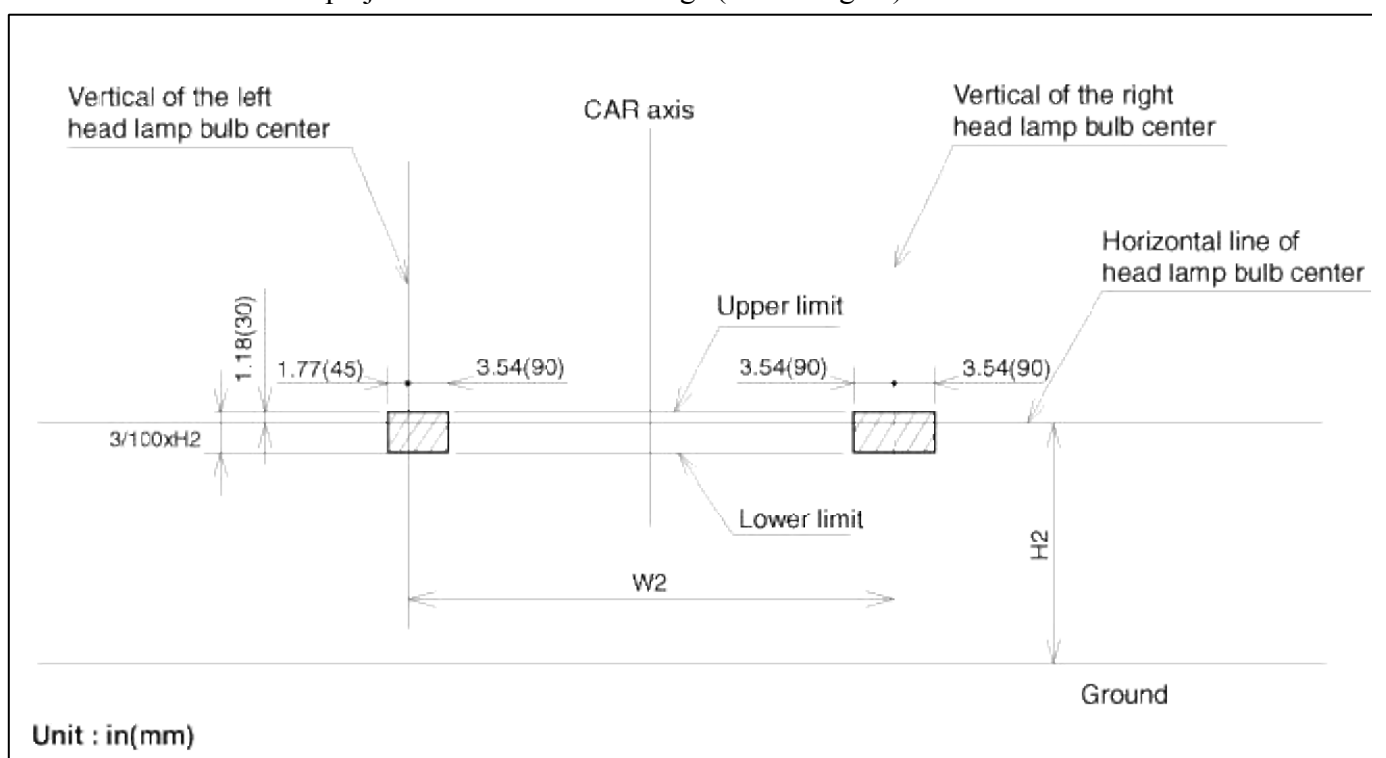
In case of equipping with the auto leveling device, set the initialization by using the diagnostic tool before aiming.

\* In case of high beam, head lamp do not need aiming with proper beam-setting equipment.



2. Turn the high beam on without the driver aboard.

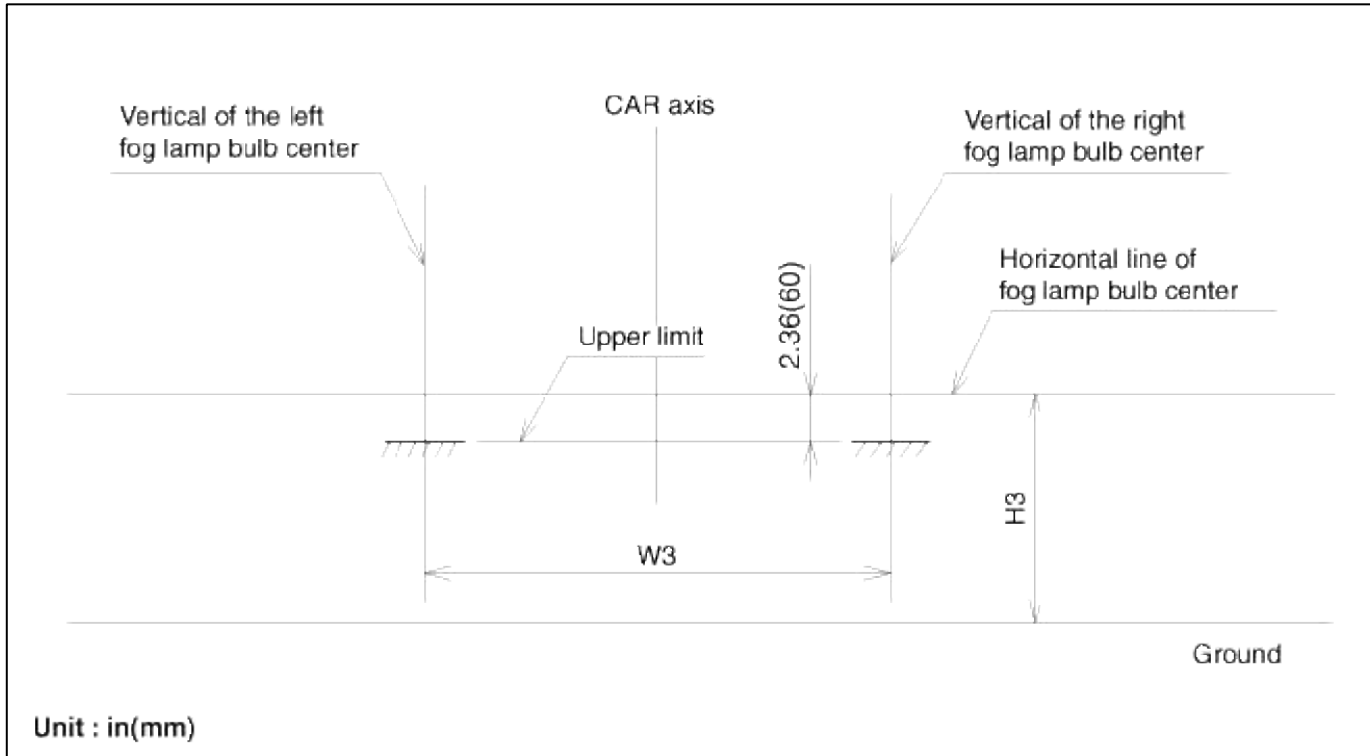
The cut-off line should be projected in the allowable range (shaded region).





3. Turn the front fog lamp on without the driver aboard.

The cut-off line should be projected in the allowable range (shaded region)

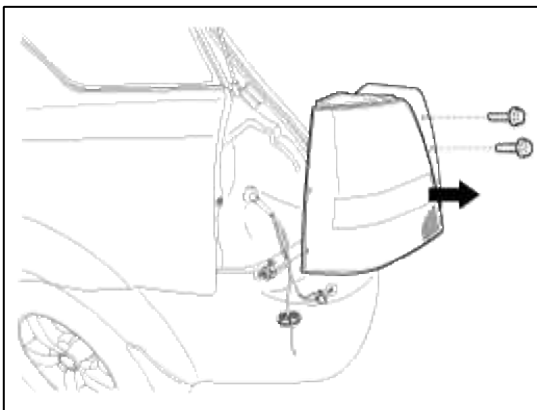


### Body Electrical System > Lighting System > Turn Signal Lamp > Repair procedures

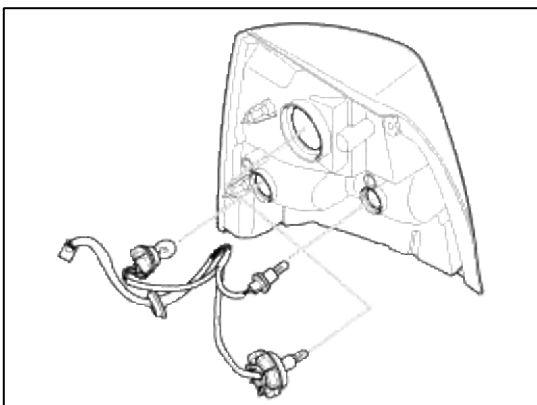
#### REMOVAL

#### REAR LAMP

1. Disconnect the negative (-) battery terminal.
2. Loose the 2 screws holding the rear combination lamp then disconnect the connector. And then remove the outside rear combination lamp assembly.

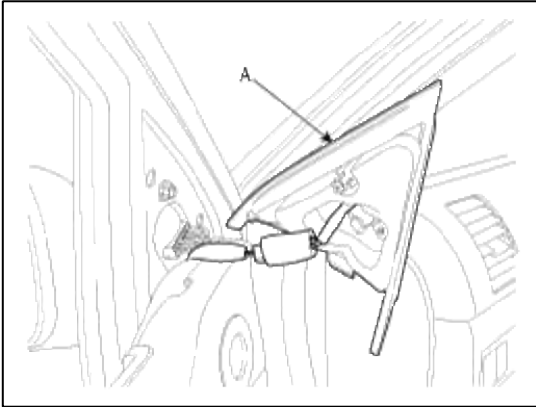


3. Remove the bulbs from the rear combination lamp assembly.

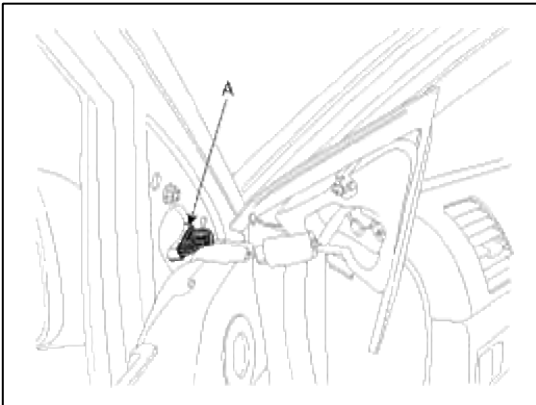


**TURN SIGNAL LAMP(DOOR MIRROR)**

1. Disconnect the negative (-) battery terminal.
2. Remove the tweeter speaker cover (A). (Refer to the Front Door in BD Group)



3. Disconnect the door mirror connector (A).



4. Loosen the 3 bolts then remove the door mirror.

**CAUTION**

Turn signal lamp of door mirror uses LED (Light-emitting Diode).

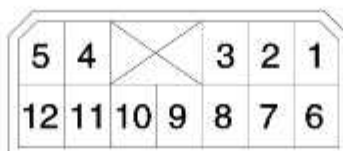
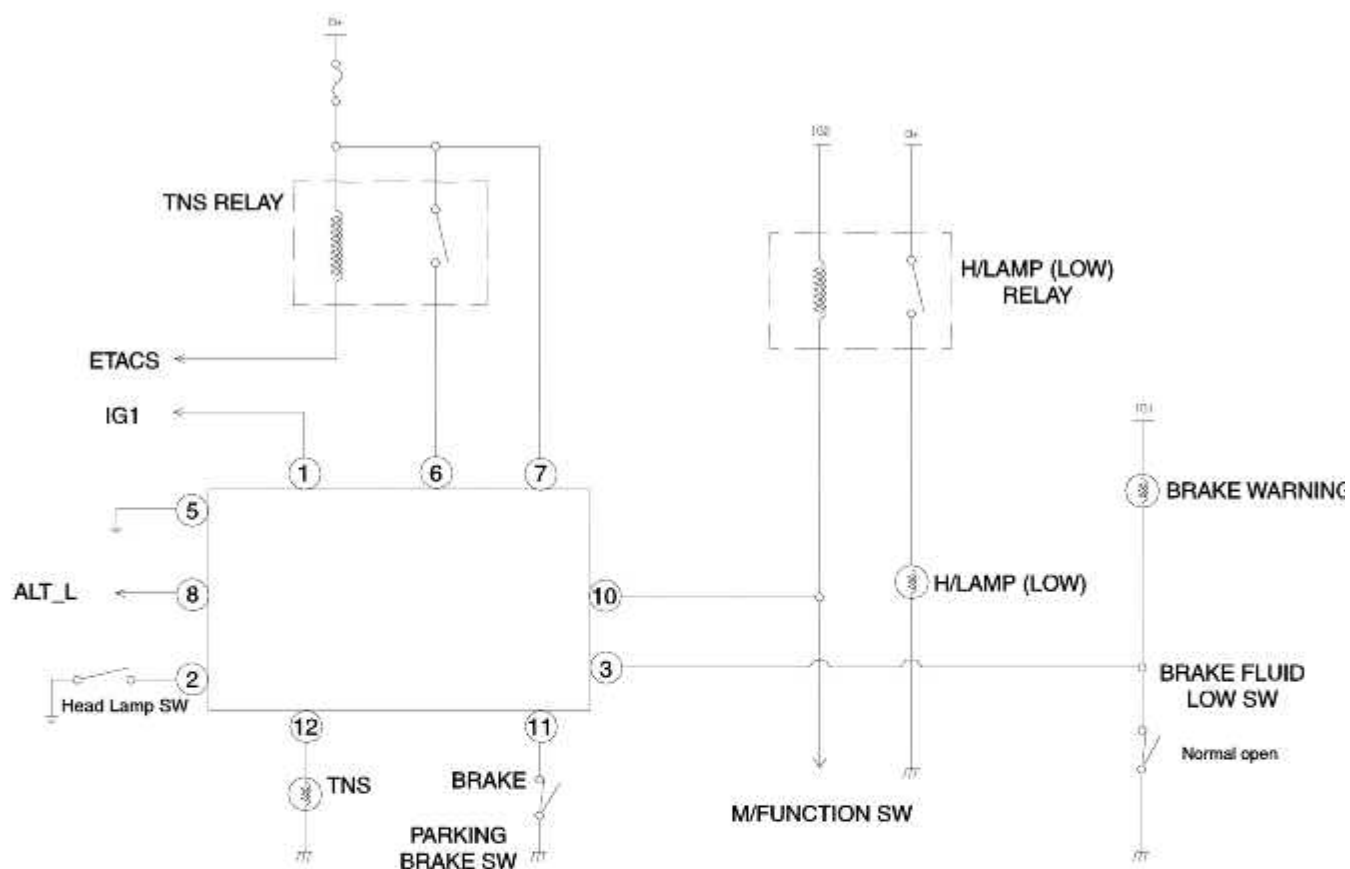
**INSTALLATION****REAR LAMP**

1. Connect the bulbs to the rear combination lamp assembly.
2. Connect the rear combination lamp connector.
3. Reassemble the rear combination lamp assembly.

**TURN SIGNAL LAMP(DOOR MIRROR)**

1. Reassemble the door mirror to the door.
2. Connect the door mirror connector.
3. Reassemble the tweeter speaker.

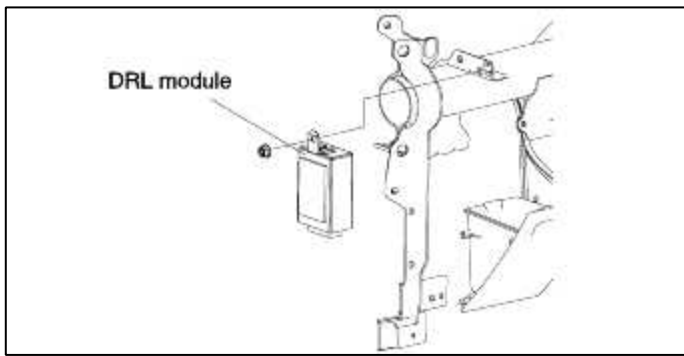
**Body Electrical System > Daytime Running Lights > Schematic Diagrams****CIRCUIT DIAGRAM (For Canada)**



## Body Electrical System > Daytime Running Lights > Repair procedures

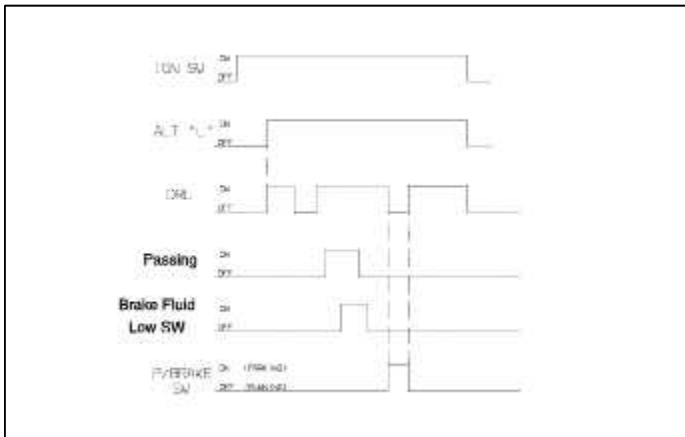
REMOVAL AND INSTALLATION (For Canada)

1. Remove the driver side lower crash pad panel and disconnect the wire connector to DRL module.



INSPECTION (For Canada)

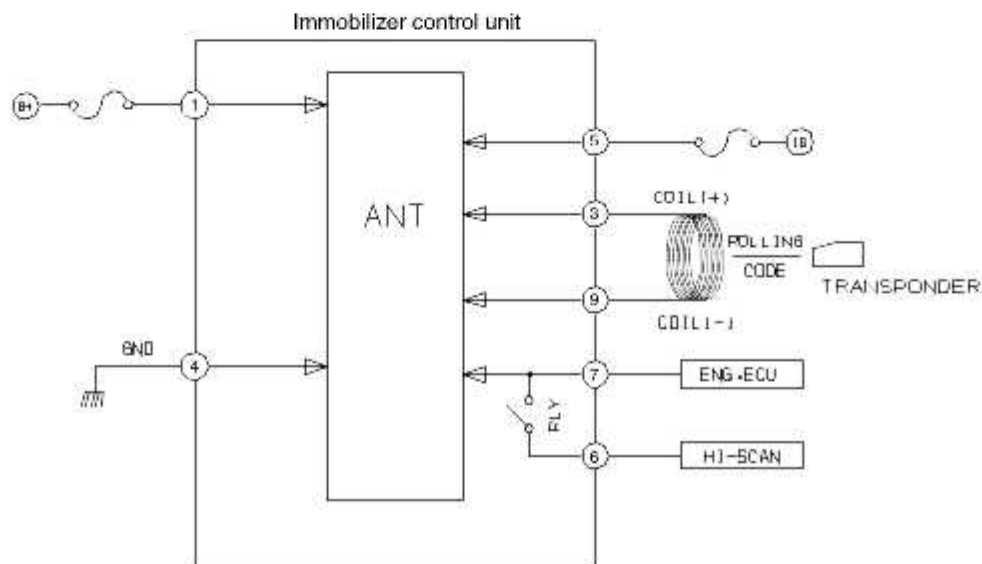
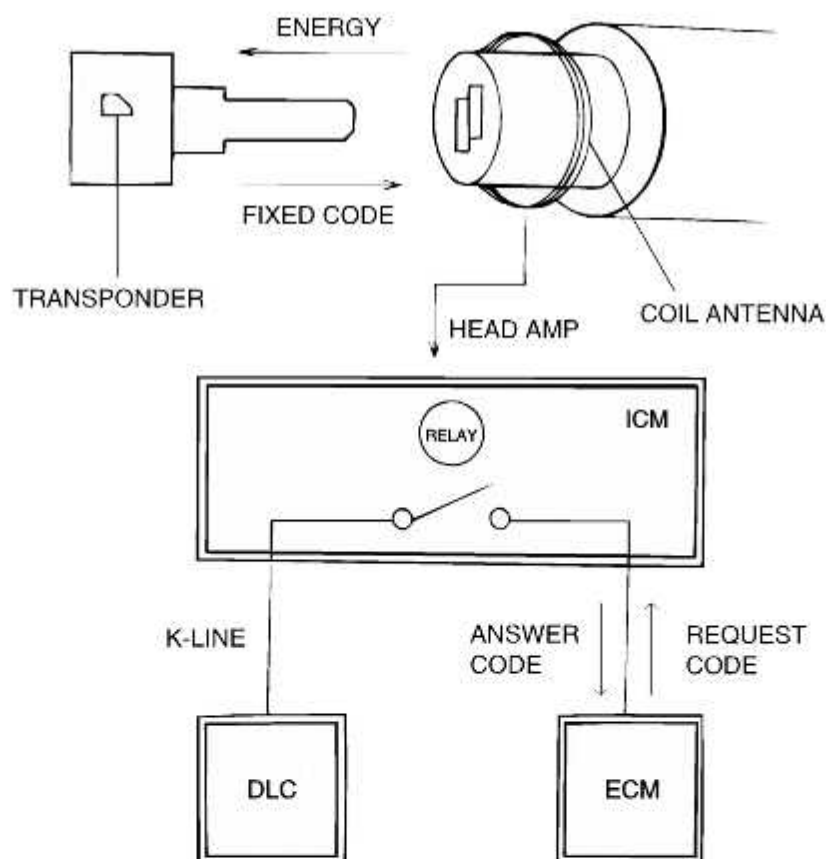
## OPERATION CHECK



## Body Electrical System > Immobilizer System > Schematic Diagrams

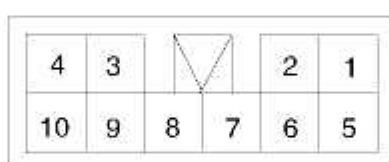
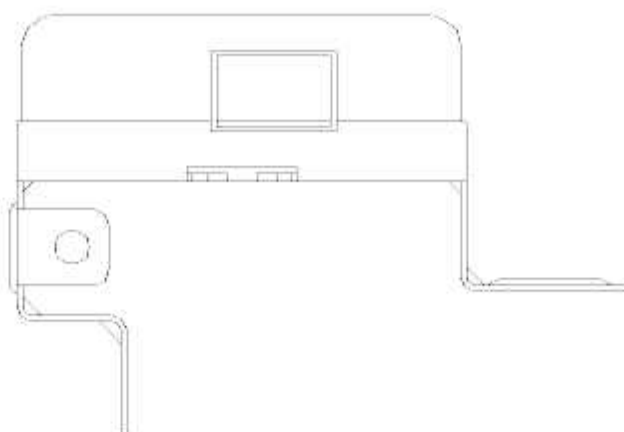
Shinchang Immobilizer (For Canada)

System block diagram



Shinchang Immobilizer (For Canada)

#### Pin connection




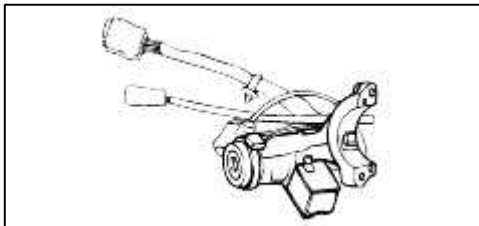

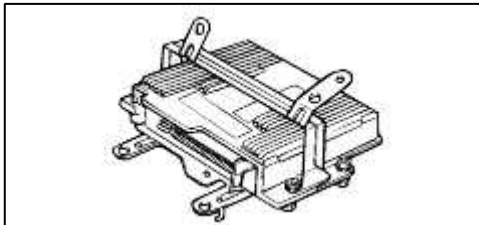
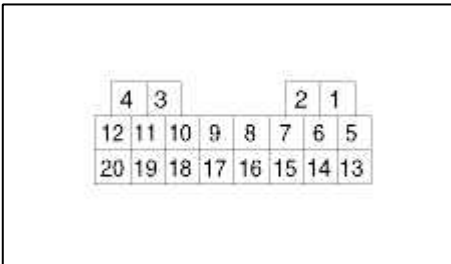

#### PIN CONNECTION

No.	Terminal
1	Battery
2	-
3	Coil antenna (+)
4	Ground
5	IGN. 1
6	DIAG. Tester (Hi-scan)
7	ENG - ECU
8	-
9	Coil antenna (-)
10	-

### Body Electrical System > Immobilizer System > Description and Operation

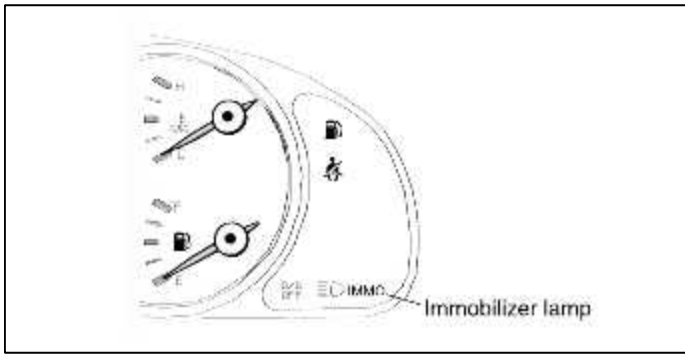
Shinchang immobilizer (For Canada)

#### System components

COMPONENT		DESCRIPTION
KEYS	ID KEY	Must be used first to register unique ID code in the ICM. This ID code is then recorded into the master keys.
	MASTER KEY	Once the ID code is recorded into the MASTER KEY, this key is for general use.
	TRANSPONDER (built-in-keys)	When ignition is ON, the coil supplies energy to the transponder, which in turn accumulates energy in the condenser. Once the energy supplied from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID code.
COIL ANTENNA		
		Supplies energy to the transponder. Receives signal from the transponder. Sends transponder signal to the ICM.
IMMOBILIZER CONTROL MODULE		
		Supplies power to the coil antenna. Receives and analyses signal from the coil antenna. Transmits signal to ECM. Stores VIN which is composed of ID code and password.
ENGINE CONTROL MODULE		
		In the ignition ON position, the ECM receives information from the ICM and permits injection to take place.
DATA LINK CONNECTOR		
		By connecting the voltmeter or Hi-scan, the control module diagnostic code can be read.
DIAGNOSTIC TESTER		
		Has the function of ICM, ECM, and keys diagnosis and change.

## IMMOBILIZER LAMP

Immobilizer lamp is an indicator of the state of immobilizer system.

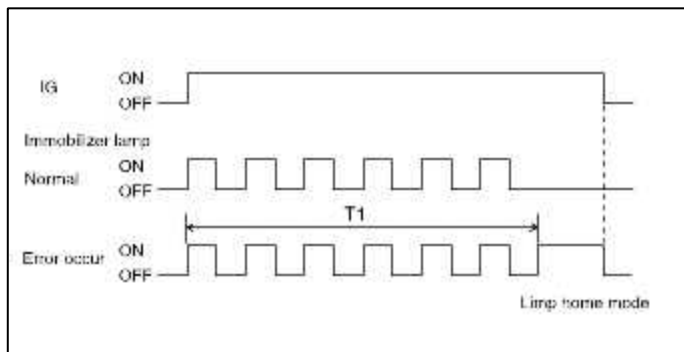


Cases of success (OK means):

- Lamp should be blinked 5 times, when IG on, and then engine start is possible.

Cases of non-success (NG means):

- If the transponder identification is failed or communication error is occurred, the lamp is continuously turned on and then the mode is entered into the limp home mode.
- During limp home password entering sequence, the lamp reflects the IGN1 signal state : if IG is ON, then lamp is ON, if IG is OFF, then lamp is OFF.



Time specification

T1 :  $6.0 \pm 0.3$  sec.

### Body Electrical System > Immobilizer System > Troubleshooting

#### DIAGNOSIS OF IMMOBILIZER FAULTS

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function).

The following table shows the assignment of immobilizer related faults to each type:



Immobilizer Related Faults	Fault types	Diagnostic codes
SMARTRA fault	1. No response from SMARTRA 2. Antenna coil error 3. Communication line error (Open/Short etc.) 4. Invalid message from SMARTRA to PCM(ECM)	P1690 (SMARTRA no response)
Transponder key fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the magnetic field (Antenna coil)	P1693 (Transponder no response error/invalid response)
EMS internal permanent memory fault	1. EMS internal permanent memory fault 2. Invalid write operation to permanent memory	P1695 (EMS memory error)
Invalid key fault	1. Virgin transponder at PCM(ECM) status "Learnt" Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail)	P1696 (Authentication fail)
Hi-Scan fault	1. Hi-Scan message error	P1697
Transponder invalid	1. Invalid transponder	P1698

#### IMMOBILIZER (SMARTRA) DTC LIST

No.	Fault code	Monitor strategy description	Gasoline
1	P1690	SMARTRA no response	O
2	P1693	Transponder no response error / Invalid response	O
3	P1695	EMS memory error	O
4	P1696	Authentication fail	O
5	P1697	HI-SCAN message error	O
6	P1698	Transponder Invalid	O

#### Body Electrical System > Immobilizer System > Repair procedures

Shinchang Immobilizer (For Canada)

#### Password setting

Password can be used to register the master keys when you lost the ID key by using a tester (such as Hi-scan).

##### 1. Initial password

The initial password for ICM has been set by the manufacturer as 2345.

Key can be registered and corrected by using the initial password until a new password is registered.

##### 2. Password registration and ;change

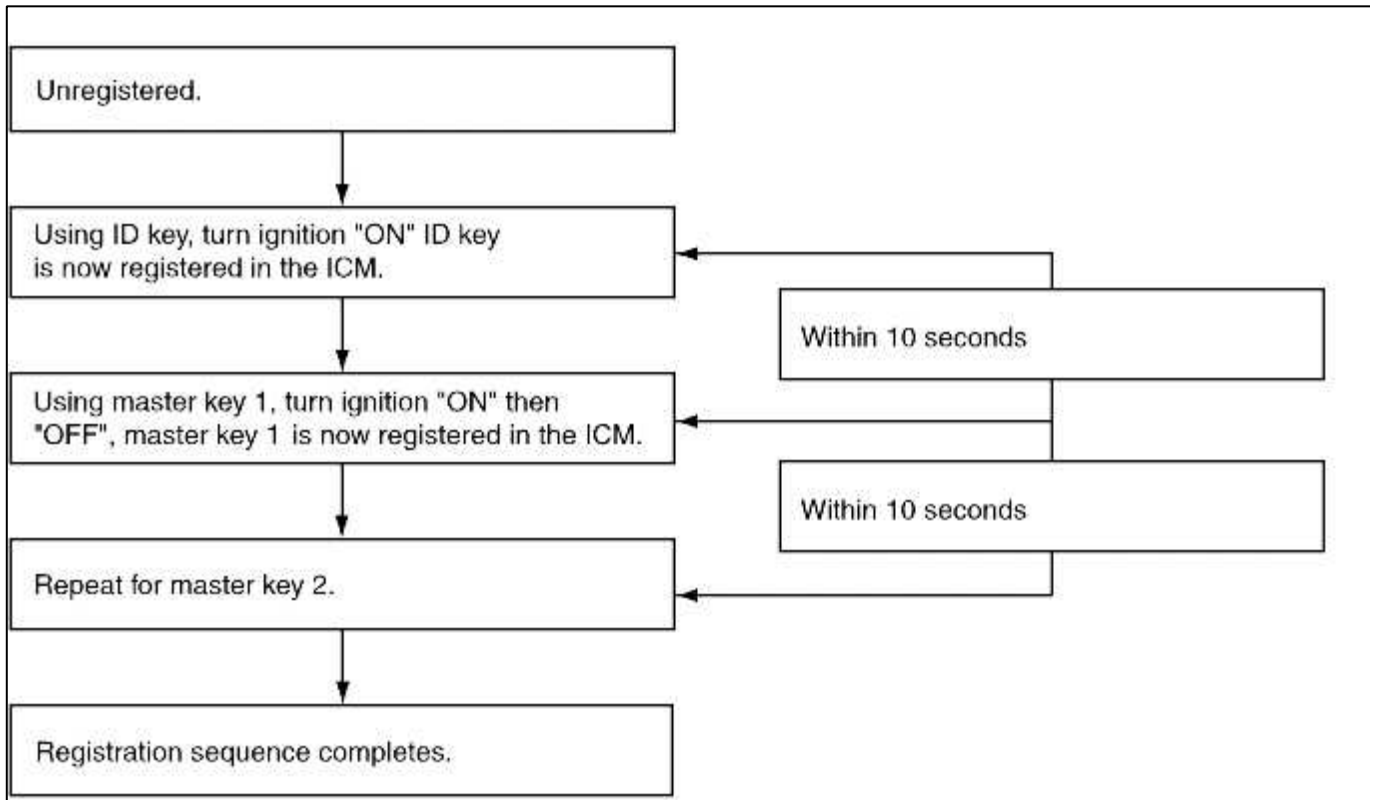
Using a tester(Hi-scan), the initial password(preset as2345 all) can be replaced by a new password nominated by the owner.

4 numbers among 0-9 can be registered as password.

Once the password has been changed from 2345, the ICM is ready to record the ID code.

## Keys registration and correction

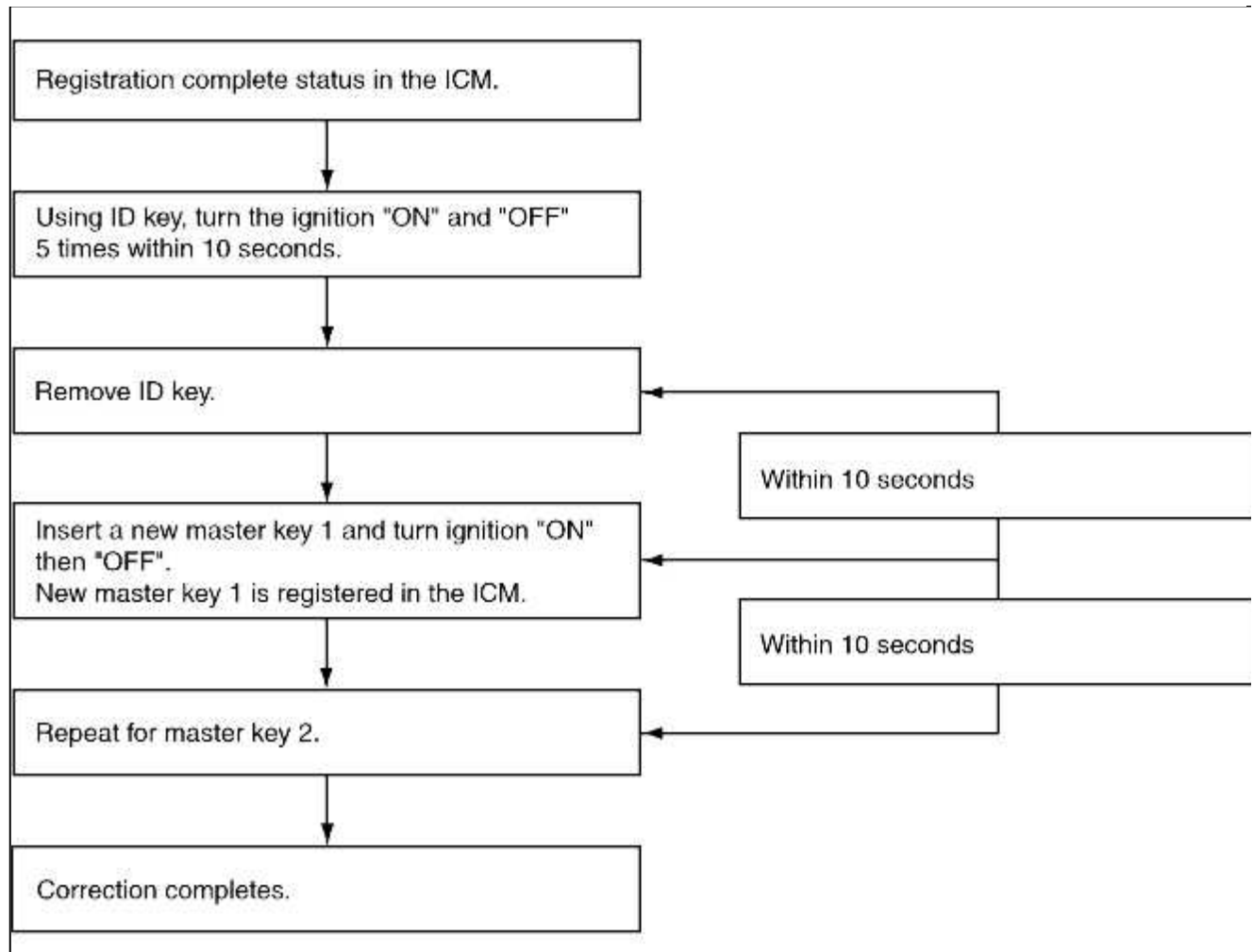
## 1. Initial registration method



## 2. Registration correction for master keys

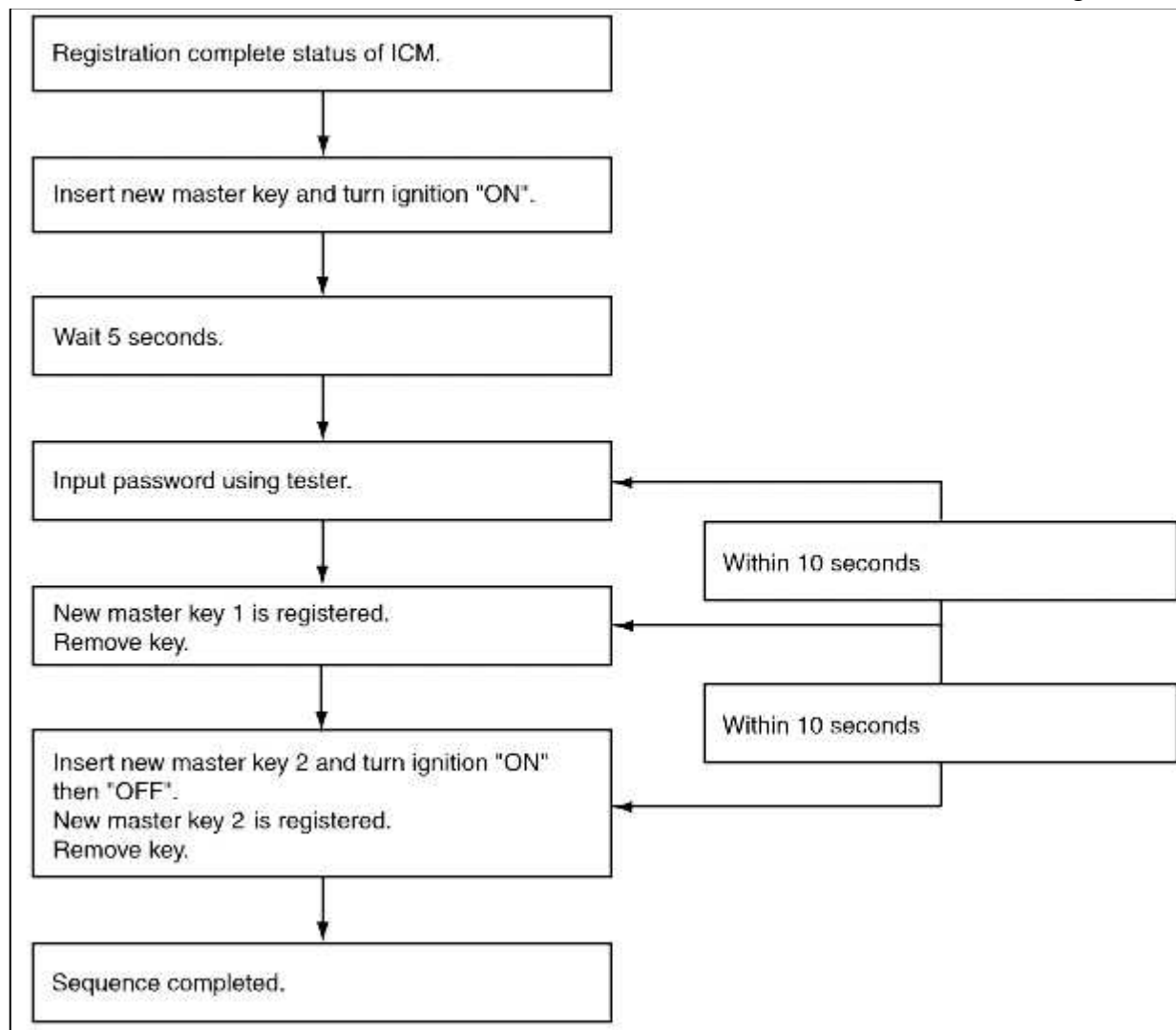
In cases when the master key is lost or where a new set of master keys need to be produced, it can be achieved using the following methods.

## (1) Using ID key



(2) Using password

When the customers lost the ID key, new master keys can be registered by using Hi-scan only.  
ID key can not be corrected and reproduced.

**NOTE**

Once the password is mis-registered, it is impossible to register new password during 10 seconds regardless of ignition ON/OFF.

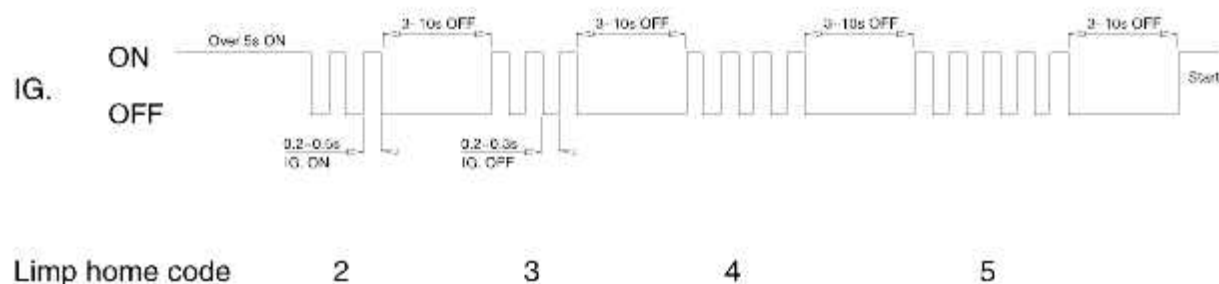
When the new master keys have been registered, the codes for existing master keys are all cleared.

### Limp home (override) procedure by ignition key

This procedure allows the unlocking of the EMS by entering the user password via the IG SW, in case the transponder code cannot be read or is unknown after ignition-ON, a valid transponder code must have been received, otherwise the EMS will remain "Locked" and the lamp will start blinking. This can happen through a malfunction of the transponder, the reading device or an unknown transponder code.

The number of IG ON/OFF must coincide with the password.

ECU Status	Is limp home procedure possible?
Learnt	Yes
Neutralized	No
Virgin	No

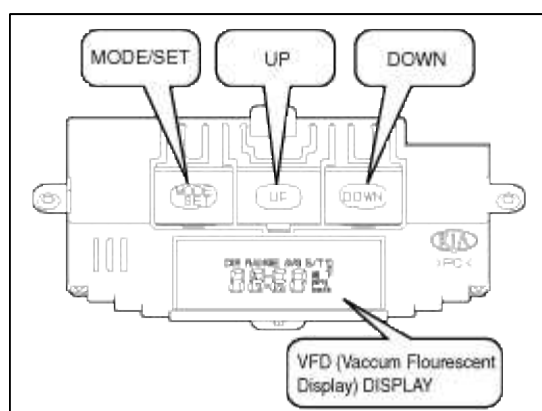


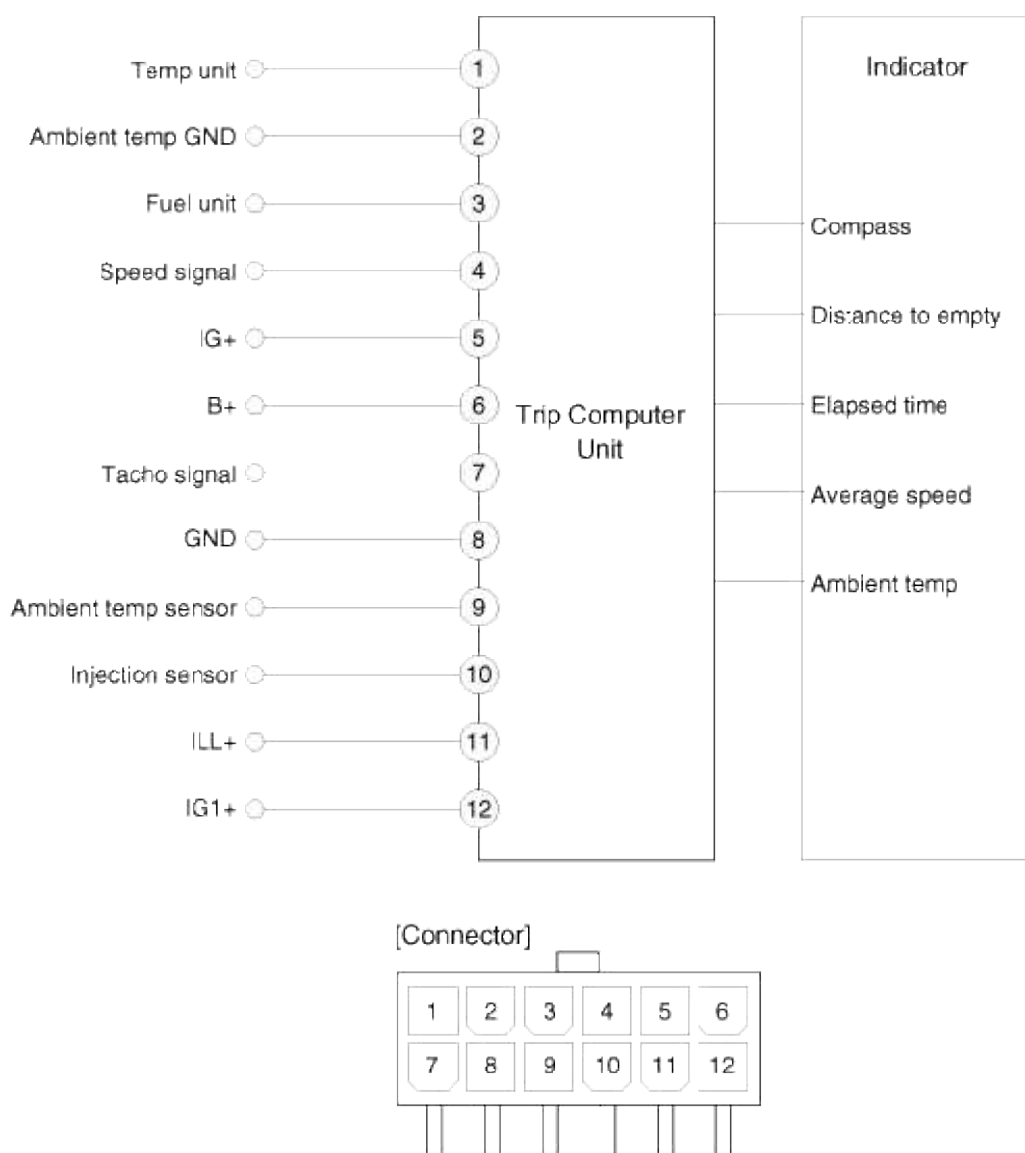
Only if the EMS is in status "learnt" and the user password status is "learnt" and the user password is the correct one, the EMS is unlocked for approximately 10 seconds. The engine can be started during this time. After elapsing of timer no engine start is possible. After new input of user password the time starts again. After ignition off the EMS is locked. For next start the input of user password is requested again.

## Body Electrical System > Trip Computer > Description and Operation

### DESCRIPTION

The trip computer displays information related to driving, including compass, distance to empty, elapsed time, average average speed and outside temperature on the display. To change the function as described below, push the MODE/SET button less than 0.1~1.5 sec. (DIR → Distance to empty → average speed → elapsed time → outside temperature → OFF, Without outside temperature sensor ; elapsed time → OFF → DIR).





## OPERATION

### SWITCH FUNCTION

Switch	Function	Remark
MODE / SET	Selection of modes	
	Correction of relative azimuth compass indicator	
	Correction of terrestrial deviation of azimuth compass	
	Clear the average vehicle speed or driving time to "0"	
UP / DOWN	Correction of the terrestrial deviation angle of azimuth compass	
	Conversion of the units (Distance to empty, Temperature, Average vehicle speed)	

## COMPASS

The vehicle compass displays the direction (8 directions) where the vehicle is heading. Compass is displayed when driving.



[Compass display]

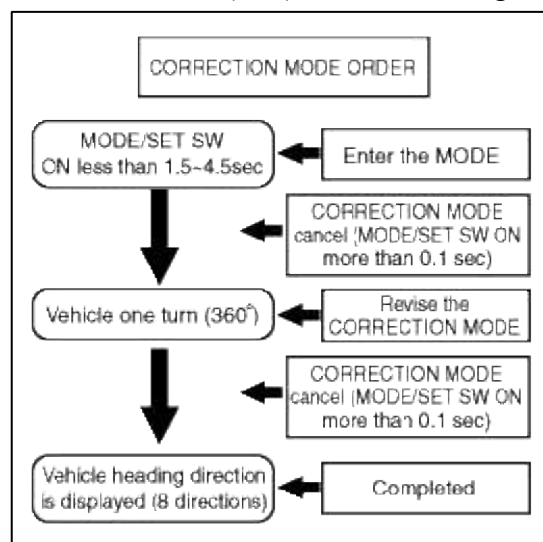
NO	Switch point	Heading(+22.5°)	2nd line	3rd line
1	N	0	N	
2	NE	45°	N	E
3	E	90°		E
4	SE	135°	S	E
5	S	180°	S	
6	SW	225°	S	W
7	W	270°		W
8	NW	315°	N	W

A circular compass rose diagram showing 16 directions. The cardinal directions are labeled: N(0°), NE(45°), E(90°), SE(135°), S(180°), SW(225°), W(270°), and NW(315°). The intermediate directions are labeled: NNE(22.5°),ENE(67.5°),ESE(112.5°),SSE(157.5°),SSW(202.5°),WSW(247.5°),WNW(292.5°), andNNW(337.5°). The diagram is divided into 8 sectors by lines at 45-degree intervals.

## 1. CORRECTION MODE

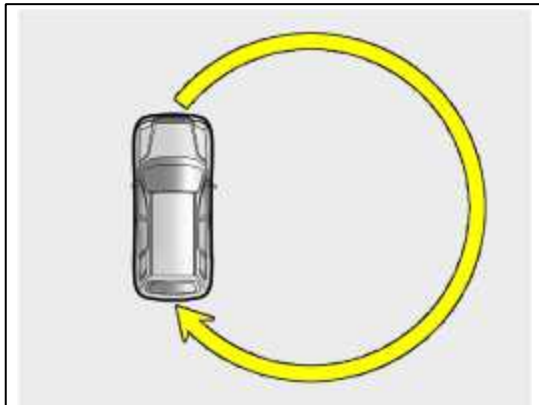
- (1) If you push the MODE/SET switch and hold for more than 1.5 second and less than 4.5 seconds, the azimuth indicator (DIR) will start blinking with the vehicle's present direction.



- (2) Slowly (about 5km/h, 3mph) rotate the vehicle one turn(360 degree) within 128 seconds.

The rotation could be made at any direction(left or right) in an open space.

- A. The correction data is updated if the automatic correction data is better than the present correction data
- B. Turning direction is not important
- C. If the correction process is not finished after the vehicle turns 360°, turn the vehicle some more degree.



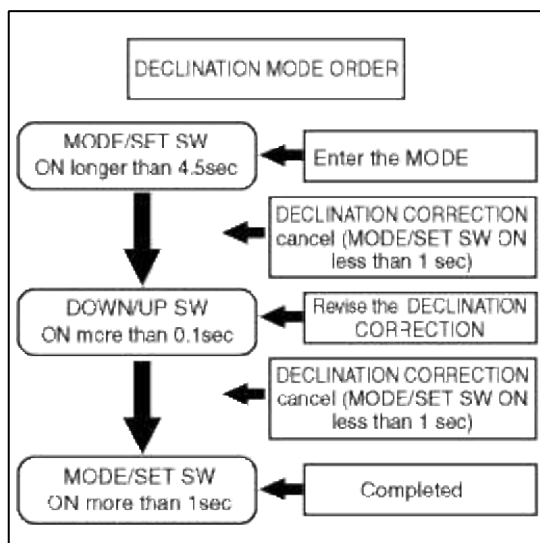
- (3) When the rotation is finished, the azimuth compass indicator (DIR) will stop blinking and the error correction is completed.

If the indicator continues to blink, rotate the vehicle a bit more until the blinking stops.

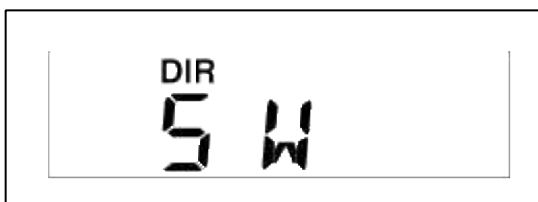
## 2. DECLINATION CORRECTION (VARIANT REGION CHANGE MODE)

Change the "Declination Setting Value" according to the regional declination to synchronize the true north and vehicle's north.

- (1) Push the mode button longer than 4.5 Sec to enter the declination correction mode. ('DIR' is blinking 4 times)

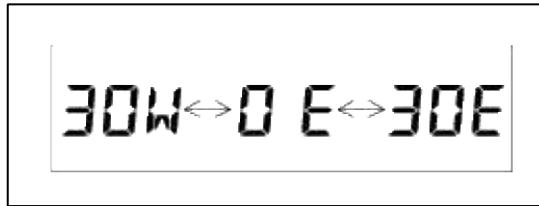


- A. Screen after blinking 4 times.





(2) Push the UP or DOWN button longer than 0.1 Sec to change the declination setting Value (Steps by 5° to Ea or WEST ; After East 30, wraps to West 30)



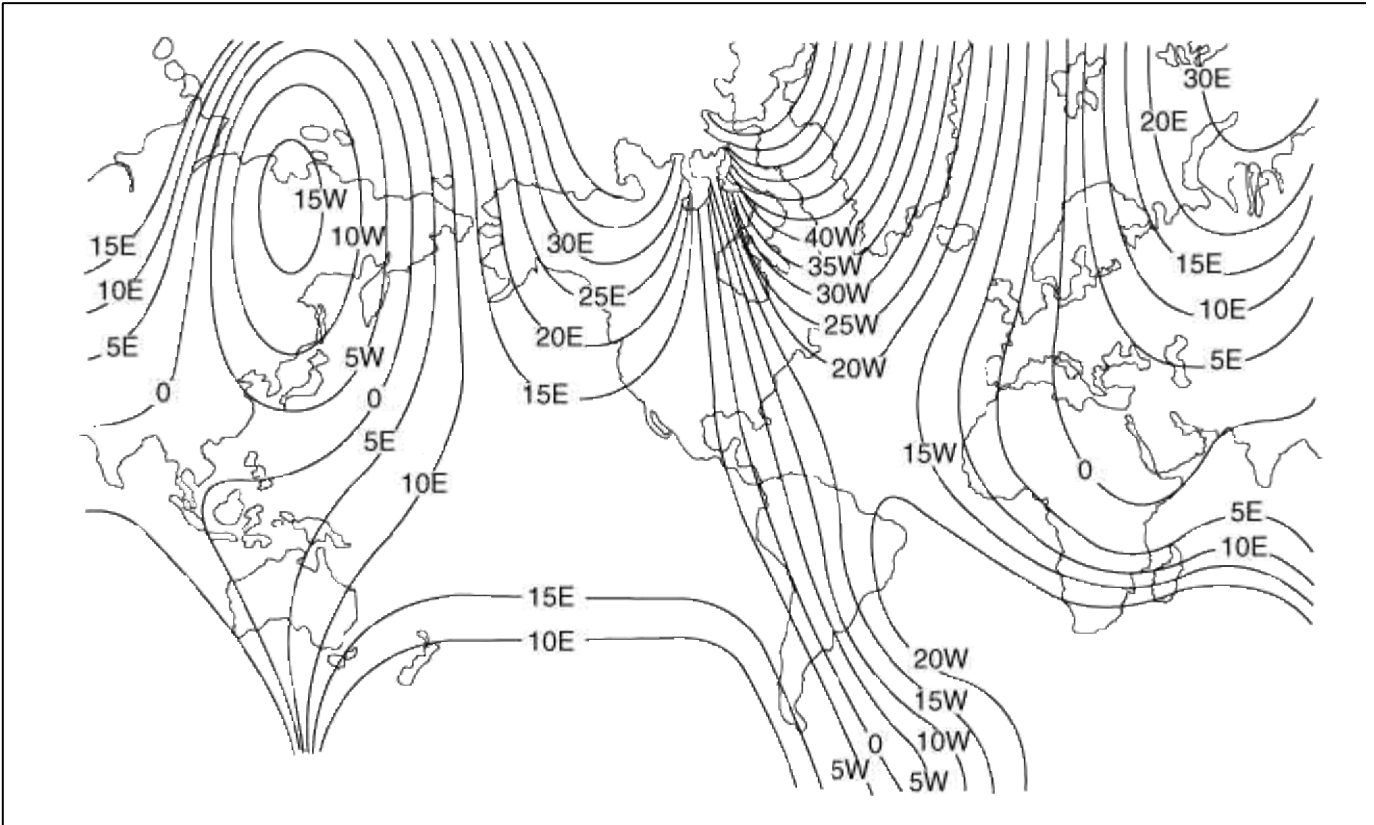
### (3) Cancellation conditions of Declination correction

- A. If you push the MODE/SET switch and hold for more than 0.1 and less than 1 seconds.
- B. Without any effective input for 30 seconds.

### CAUTION

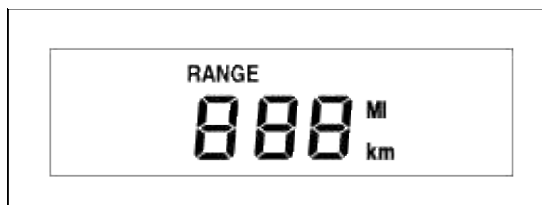
- Do not install a ski rack, antenna, etc. that are attached to the vehicle using a magnet as anything attached to the roof of the vehicle with a magnet will effect compass operation.
- If the compass deviates from the correct indication soon after repeated adjustment, have the compass checked at an authorized dealer.
- The compass may not indicate the correct compass point in tunnels or while driving up or down a steep hill. (The compass returns to the correct compass point when the vehicle moves to an area where the geomagnetism is stabilized.)
- Declination correction and correction setting value is not deleted during the B(+) OFF.

## The Contour Line Map for Terrestrial Deviation Angle Correction



## Distance to Empty

This mode indicates the estimated distance to empty from the current fuel in the fuel tank.



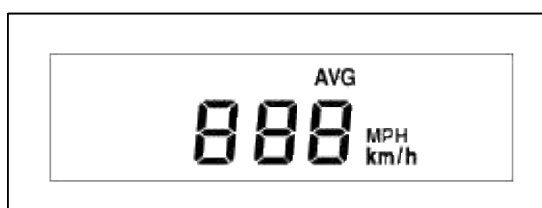
1. When the remaining distance is below 50 km (30 miles), a blinking "---" symbol will be displayed.
2. If you press the "DOWN" switch for more than 5 seconds, the distance unit would transfer to "km" from "MI (mile)" or "MI" from "km".

#### CAUTION

The figure of distance to empty is estimated driving distance, so it can be different from the driving distance really is.

#### Average Speed

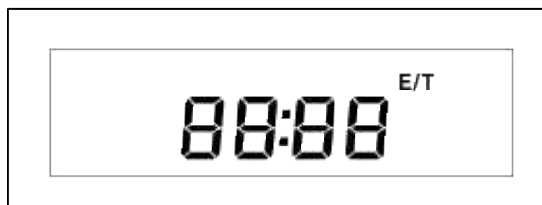
This mode indicates the average speed from the starting of the vehicle to the ignition key "OFF".



1. When the ignition key is "OFF", it will initialize to 0 km/h (0 mph).
2. If you press the "DOWN" switch for more than 5 seconds, the speed unit would transfer to "km/h" from "MPH" or "MPH" from "km/h".
3. It will be reseted, if you press the MODE/SET switch ON offr more than 1.5 seconds.

#### Elapsed Time

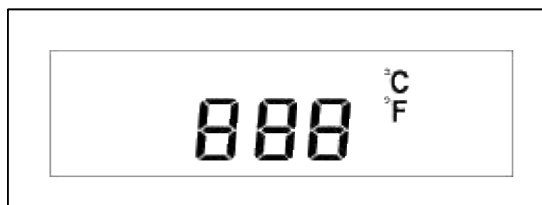
This mode indicates the total time from the starting of the vehicle to the ignition key "OFF" after resetting.



1. Push "MODE/SET" for more than 1.5 seconds to initialize the displayed information such as driving time.

#### Outside Ambient Temperature

This mode indicates the current ambient temperature. The meter's working range -30°C (-40°F) to 65°C (149°F).

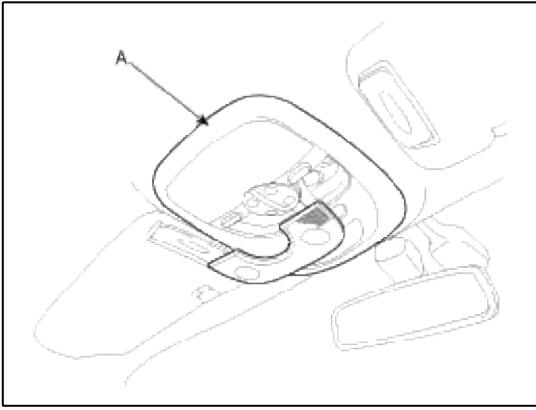


1. If you press the "DOWN" switch for more than 5 seconds, the temperature unit would transfer to "°C" from "°F" or "°F" from "°C".
2. Temperature is updtued every 4 seconds (Tolerance : ±4°C)

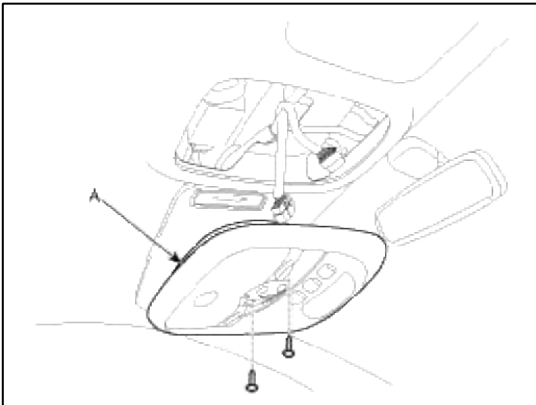
### Body Electrical System > Trip Computer > Repair procedures

#### REMOVAL

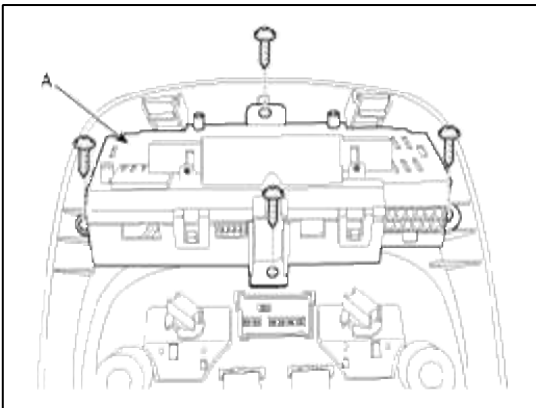
1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console lamp cover(A).



3. Disconnect the sunroof switch connector and trip computer connector after loosening the screws (2EA) and then remove the overhead console lamp (A) from the head lining.



4. Remove the trip computer (A) from overhead console after removing the fixed screws (4EA).



## INSTALLATION

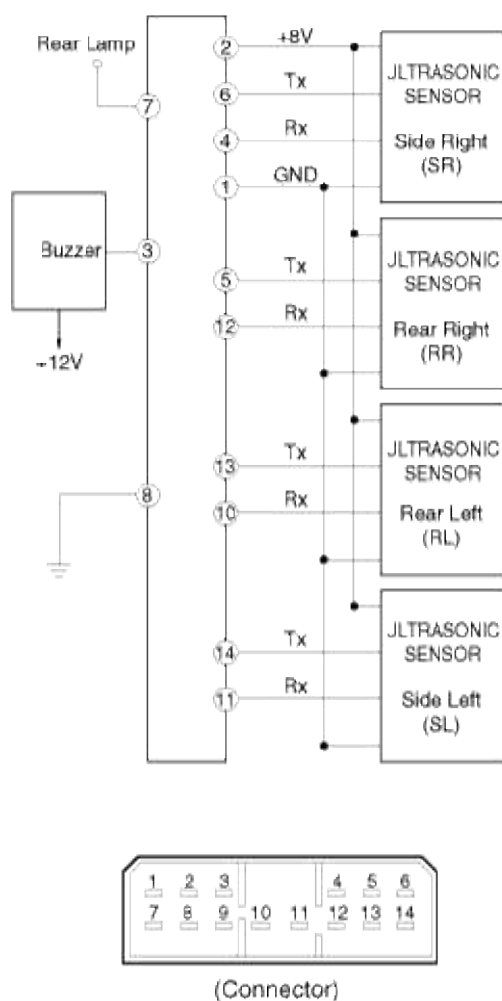
1. Reassemble trip computer to the overhead console.
2. Connect the sunroof switch connector and trip computer connector.
3. Reassemble the overhead console.

## Body Electrical System > Back Warning System > Specifications

## SPECIFICATION

Item		Specification
Back warning control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 600 mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage rating	DC 8 V
	Detecting range	40 cm ~ 120 cm
	Operation voltage	DC 7.5~8.5 V
	Operation current	MAX 20 mA
	Operation temperature	-30°C ~ + 80°C
	Conservation temperature	-40°C ~ + 85°C
	Operation frequency	40 ± 5 KHz
	Number of sensors	4 (Rear Left, Right, Side Left, Right)
Piezo buzzer	Voltage rating	DC 12 V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.2±0.5 KHz
		Sound level : 70 dB (DC 13V, 1m)

**Body Electrical System > Back Warning System > Back Warning Control unit > Schematic Diagrams**
**CIRCUIT DIAGRAM**



Pin No.	Signal	Test : Desired result
1	GND SENSOR	0V
2	+8V SENSOR	8V (While operating)
3	PIEZO BUZZER	0V (While operating)
4	RX-SR SENSOR	0~1V Voltage change (Inspect waveform)
5	TX-RR SENSOR	0~3V Voltage change (Inspect waveform)
6	TX-SR SENSOR	0~3V Voltage change (Inspect waveform)
7	BACK UP LAMP POWER	12V (While shifting to "R")
8	GND	0V
9	N.C	0~1V Voltage change (Inspect waveform)
10	RX-RL SENSOR	0~1V Voltage change (Inspect waveform)
11	RX-SL SENSOR	0~1V Voltage change (Inspect waveform)
12	RX-RR SENSOR	0~1V Voltage change (Inspect waveform)
13	TX-RL SENSOR	0~3V Voltage change (Inspect waveform)
14	TX-SL SENSOR	0~3V Voltage change (Inspect waveform)

## Body Electrical System > Back Warning System > Back Warning Control unit > Description and Operation

### DESCRIPTION

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, back warning system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third

alarm).

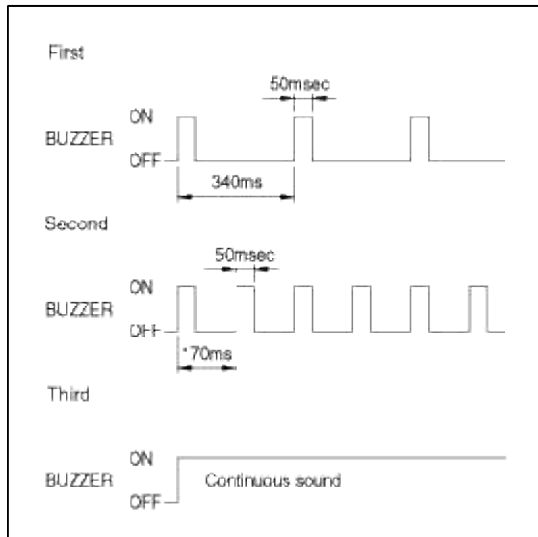
## ALARM RANGE

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.

First alarm : Object comes near to the sensor located at the rear of vehicle, within  $81\text{-}120\text{cm} \pm 15\text{cm}$

Second alarm : Object comes near to the sensor located at the rear of vehicle, within  $41\text{-}80\text{cm} \pm 10\text{cm}$

Third alarm : Object comes near to the sensor located at the rear of vehicle, within  $40\text{cm} \pm 10\text{cm}$

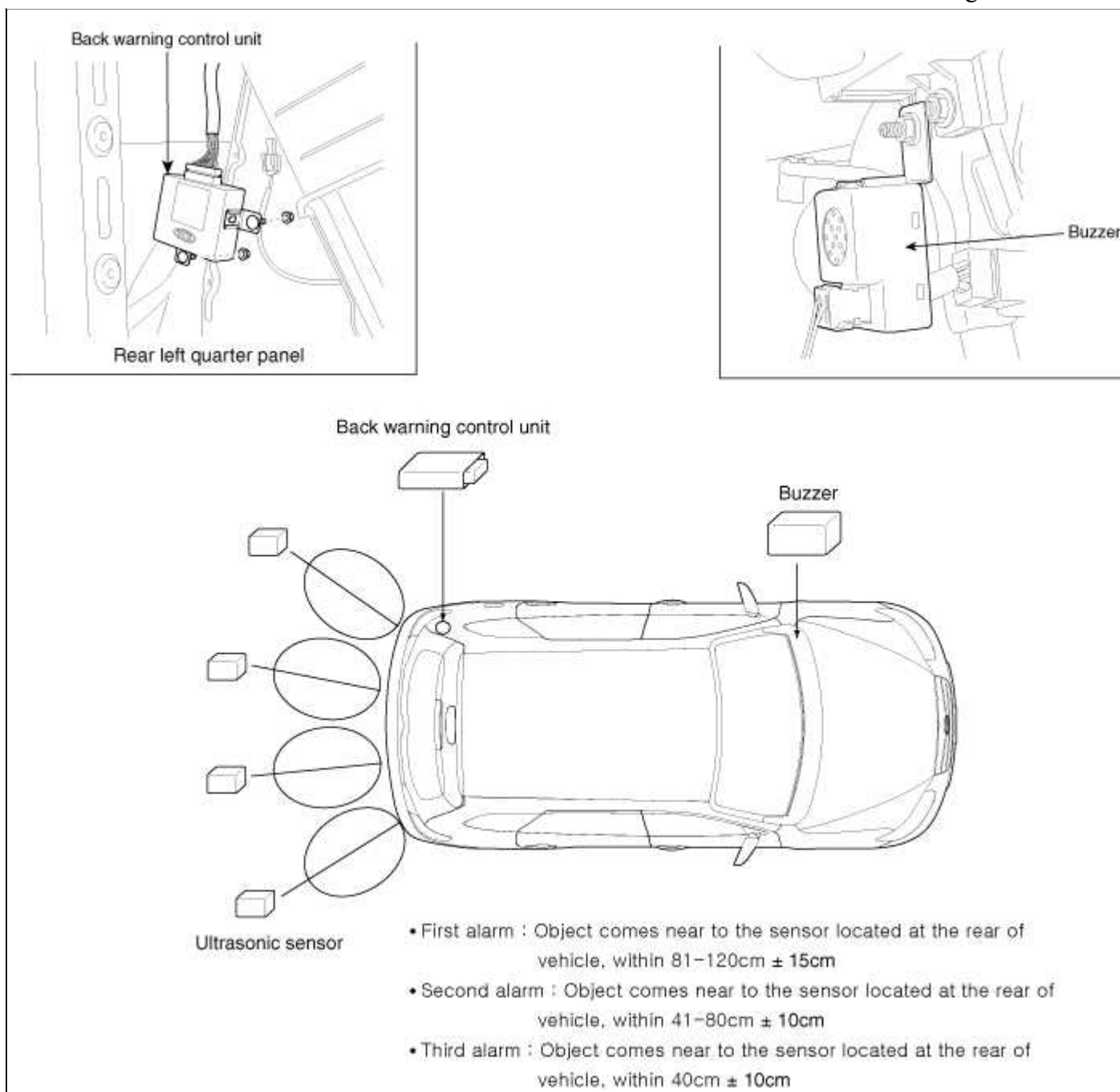


### NOTE

1. Time tolerance of the above waveform : Time  $\pm 10\%$
2. At nearer distance than 40cm, detection may not occur.
3. Alarm will be generated with vehicle reversing speed 10km/h or less.  
For moving target, maximum operation speed shall be target approach speed of 10km/h.
4. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
5. False alarm, or failure of the alarm to trigger may occur in the following conditions.
  - Irregular road surface, gravel road, reversing toward grass.
  - Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
  - When a wireless transmitter is used near to the sensor.
  - Dirt on the sensor.
  - Sequential alarm may not occur due to the reversing speed or the target shape.

## Body Electrical System > Back Warning System > Back Warning Control unit > Components and Components Location

### COMPONENT LOCATION

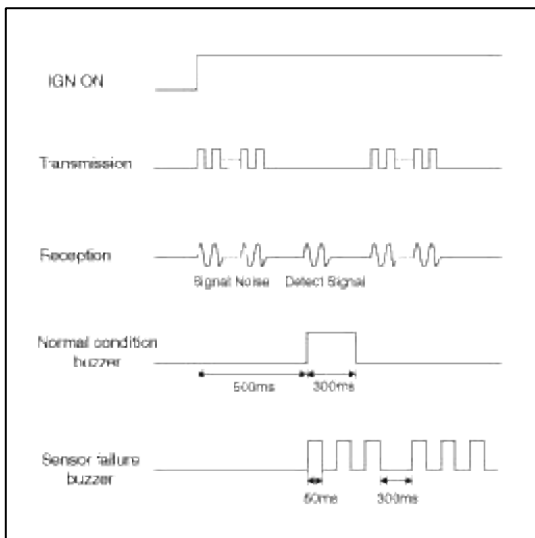


## Body Electrical System > Back Warning System > Back Warning Control unit > Troubleshooting

### DIAGNOSIS

## 1. DIAGNOSIS

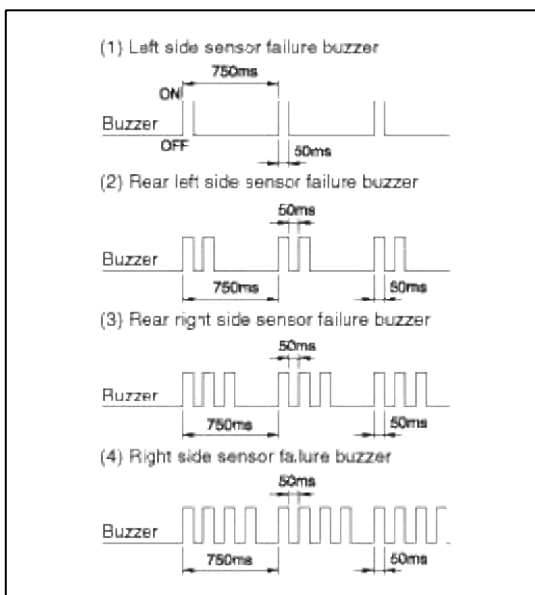
Turn the ignition switch ON, then shift the transaxle lever to 'R'. The Back Warning System is then checked. If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.5 seconds from power approval. In case of system failure, buzzer alarm is generated 3 times continuously with the interval of 0.3 seconds.



## 2. DIAGNOSIS MODE

Switch on diagnosis mode upon system failure.

In case of system failure, then it indicates the failed point as follows.



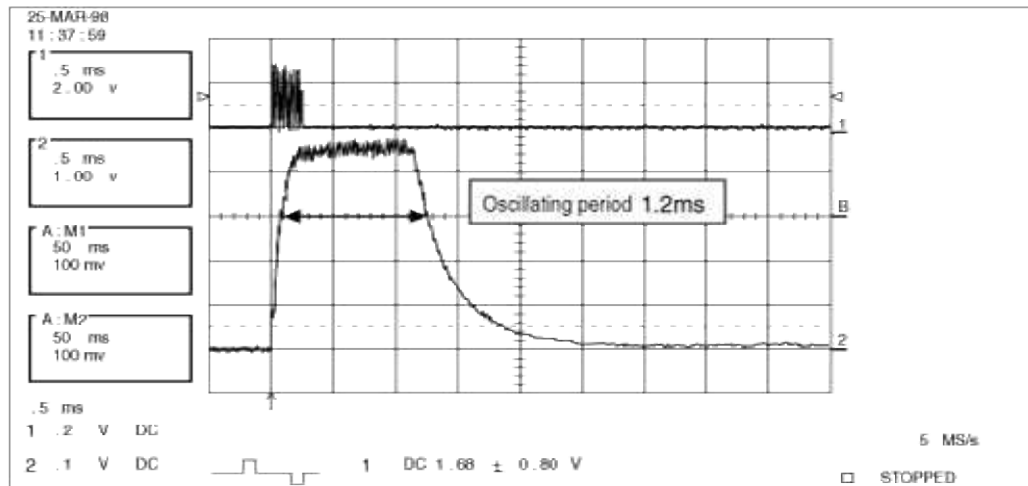
## SENSOR CONNECTION CHECKING

Transmit ultrasonic wave to the sensors, boost input signal, and detect wave.

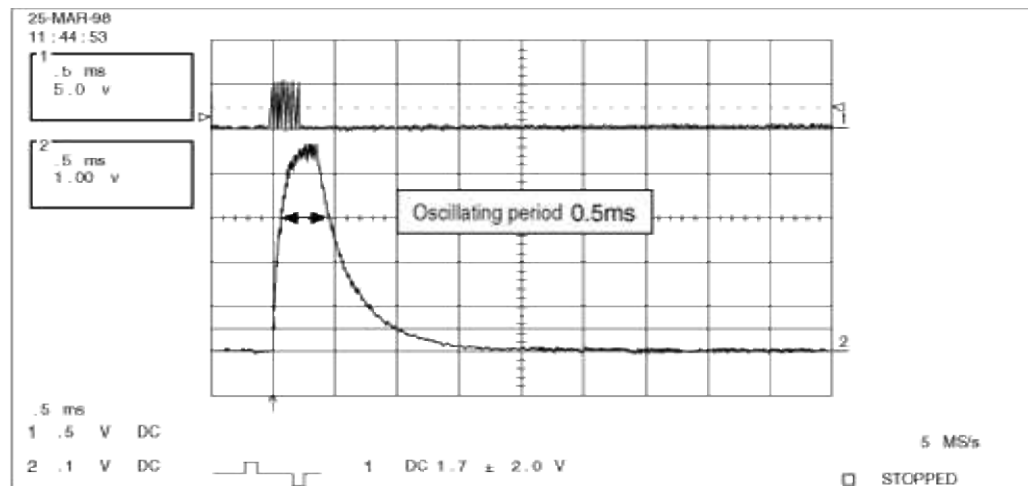
Waveform will be found, oscillating for a certain period of time.



## 1. Waveform for a normal sensor connection



## 2. Waveform for a failed sensor connection

**NOTE**

Sensor connection will be checked for oscillating period of input signal 3V. If oscillating period is more than 0.8ms, it is normal.

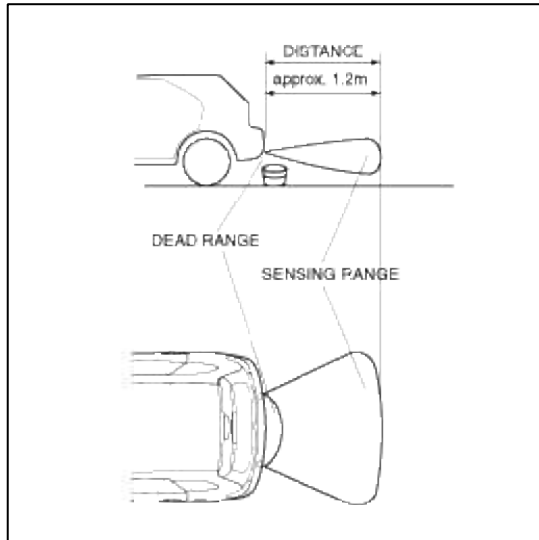
- A. Left sensor failure : beep-beep-beep
- B. Right sensor failure : beep beep-beep beep-beep beep
- C. Rear-right sensor failure : beep beep beep-beep beep beep-beep beep beep
- D. Right side sensor failure : beep beep beep beep-beep beep beep beep-beep beep beep beep

**WARNING**

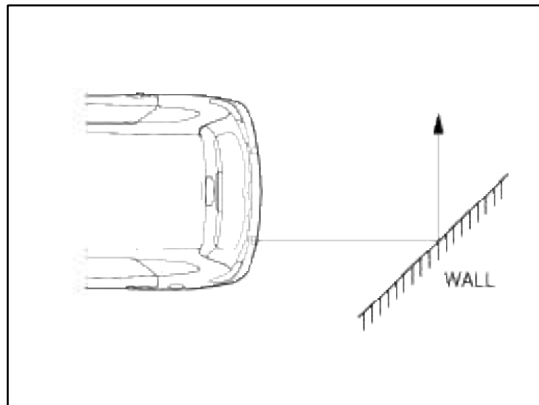
1. Range detected by back sensors is limited.  
Watch back before reversing
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.2m away unable to detect at nearer.

3. Besides there are some materials unable to be detected even in detection range as follows.

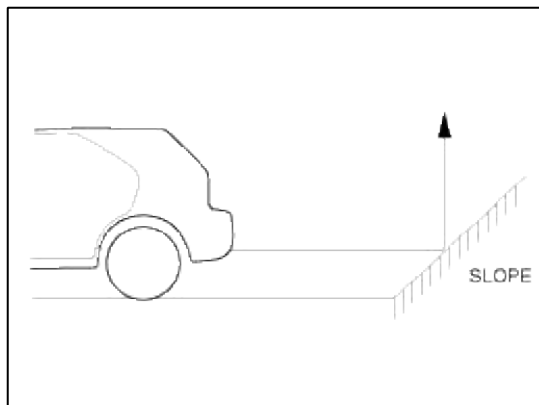
- (1) Needles, ropes, rods, or other thin objects.
- (2) Cotton, snow and other material absorbing ultrasonic wave  
(for example, fire extinguisher device covered with snow)



(3) Reversing toward the sloped walls.



(4) Reversing toward the sloped terrain.



4. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass.

Upon alarm generation by grass the alarm may be generated by rock behind grass. Always visually check the area behind the vehicle before backing up.

The sensors cannot discriminate between materials.

## 5. Sensors may not operate correctly in the below conditions.

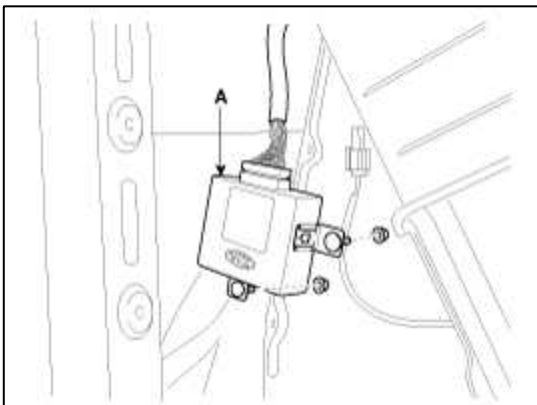
Ensure sensors are clean from mud or dirt

- (1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water. Do not wipe or scrape sensor with a rod or a hard object.
  - (2) If the sensor is frozen, alarm may not operate until sensor thaws.
  - (3) If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.
  - (4) When heavy cargo is loaded in rear cargo area, it changes the vehicle balance, which reduces the detection range.
  - (5) When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.
  - (6) Under heavy rain.
  - (7) When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite the absence of a barrier)
  - (8) If radio antenna is installed at the rear.
  - (9) If the vehicle rear wiring is re-routed or electrical component is added at the rear part.
  - (10) Vehicle balance is changed due to the replacement of the rear spring.
  - (11) The unit will operate normally when the vehicle speed is 5km/h or less.  
Above this speed, the unit may not operate normally
6. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.
  7. Be careful not to apply shock during sensor installation on the transmission or reception unit.
  8. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not to change the transmission and reception unit wiring.  
Tagging the transmission side and reception side, it may cause malfunction.
  9. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.
  10. Be careful that excessive heat or sharp objects shall not touch ultrasonic sensor surface.  
Do not cover the sensor opening or press the sensor.

### Body Electrical System > Back Warning System > Back Warning Control unit > Repair procedures

#### REPLACEMENT

1. Remove the left quarter trim of the trunk (Refer to the Interior trim in the BD group.)
2. Loosen the mounting nuts (2EA) and remove the back warning control unit (A) from the quarter panel.



### Body Electrical System > Back Warning System > Ultrasonic Sensor > Description and Operation

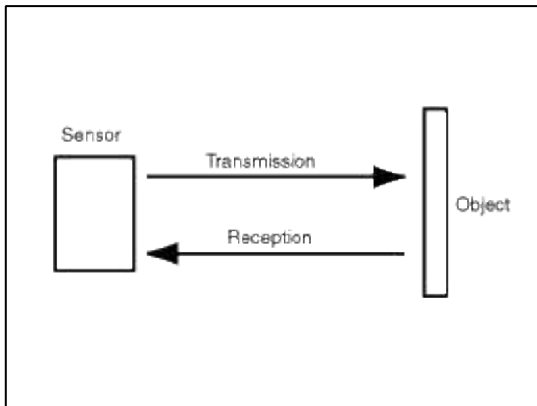
## Operation principle

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

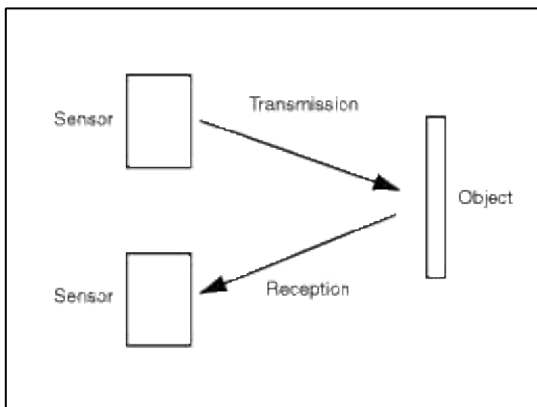
### Distance detection type

Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



## Measurement principle

Back warning system (BWS) is a complementary device for reversing. BWS detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

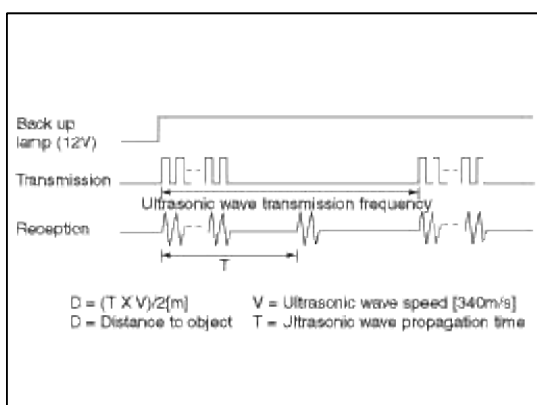
The propagation speed formula of ultrasonic wave in air is following :

$$v = 331.5 + 0.6t \text{ (m/s)}$$

$v$  = ultrasonic wave propagation speed

$t$  = ambient temperature

The basic principle of distance measurement using ultrasonic wave is :



## Sensor detection range

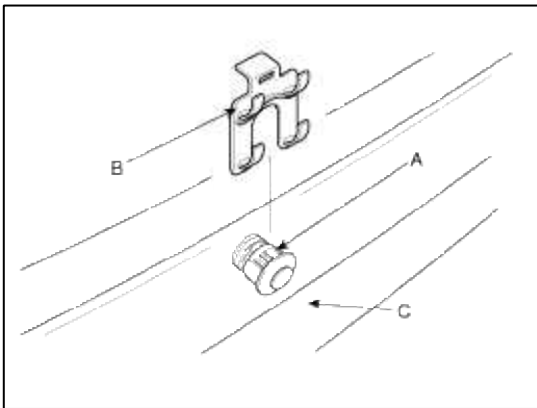
[Vertical range]

**NOTE**

1. 14cm (Diameter) plastic rod is used for the test target.
2. The test result may differ by a different target object.
3. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
4. The following object may not be detected.
  - Sharp object or thin object like rope.
  - Cotton, sponge, snow or other materials absorbing sonic wave.
  - Smaller objects than 5.5in(14cm) (Diameter), 39.4in(1m) length.

**Body Electrical System > Back Warning System > Ultrasonic Sensor > Repair procedures**
**REMOVAL**

1. Remove the rear bumper ( Refer to the Rear bumper in the BD group.)
2. Disconnect the sensor connector at the inside of the rear bumper (C), and then remove the sensor (B) from the housing (A).

**INSTALLATION**

1. Reassemble the sensor to the rear bumper, and then connect the connector.
2. Reassemble the rear bumper.

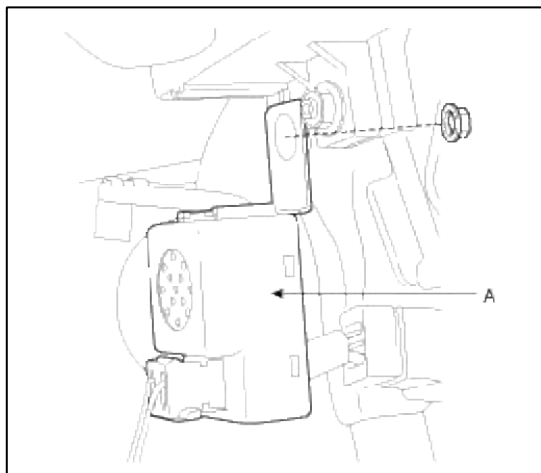
**Body Electrical System > Back Warning System > Buzzer > Repair procedures**
**INSPECTION**

Test the buzzer by connecting battery voltage to terminal 1, and ground terminal 2.  
The buzzer should make a sound. If the buzzer fails to make a sound, replace it.

**REMOVAL**

1. Disconnect the negative (-) battery terminal.
2. Remove the audio unit. (Refer to the audio in this group).

3. Remove the buzzer (A) after loosening the nut and disconnecting the connector.



## INSTALLATION

1. Reassemble the buzzer after connecting the connector.
2. Reassembly the audio unit.
3. Connect the negative(-) battery terminal.

### Body Electrical System > Troubleshooting > C0161

#### Brake lamp switch

DTC No. C0161 Brake lamp switch	Probable cause
<ul style="list-style-type: none"> <li>• Check relevant connector.</li> <li>• Check malfunction of wiring harness.</li> <li>• Check malfunction of brake lamp switch. when applying brake pedal : BV when releasing brake pedal : 0V</li> </ul>	<ul style="list-style-type: none"> <li>• Malfunction of wiring harness or connector.</li> <li>• Malfunction of brake lamp switch.</li> <li>• Malfunction of brake lamp.</li> </ul>

### Body Electrical System > Troubleshooting > P1690

#### GENERAL DESCRIPTION

The SMARTRA carries out communication with the built-in transponder of the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving. The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the ECM are converted into an RF signal, which is transmitted to the transponder by the antenna. The SMARTRA does not carry out the validity check of transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to ECM and vice versa.

\* SMARTRA : SMARt TRansponder Antenna

#### DTC DESCRIPTION

The ECM sets DTC P1690 if there's No Response from SMARTRA.

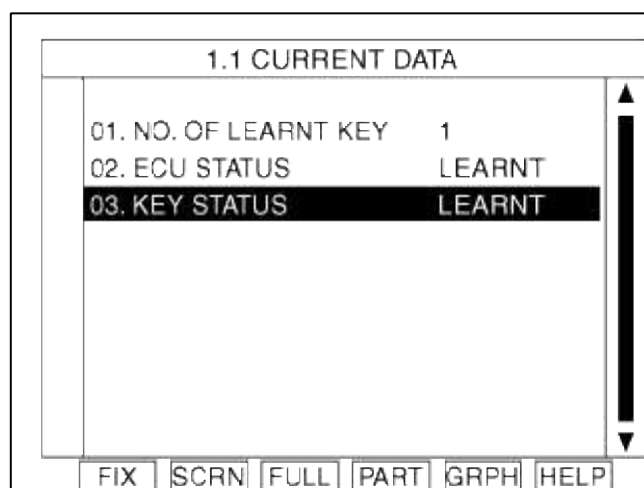
#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Open Circuit in signal harness</li> <li>• Short Circuit in signal harness</li> <li>• Faulty SMARTRA</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>• IG ON</li> </ul>	
Threshold value		
Detecting time		
FAIL SAFE		

## MONITOR DTC STATUS

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Monitor the "KEY STATUS" and "ECU STATUS" Parameter on the Scantool.

Specification : 'LEARNT'



**Fig 1**

Fig 1) The current data in abnormal state

4. Are "KEY STATUS" and "ECU STATUS" Parameter within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Inspection & Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.



3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure .

#### POWER SUPPLY CIRCUIT INSPECTION

1. Check for open in harness

(1) Ignition "OFF"

(2) Disconnect SMARTRA.

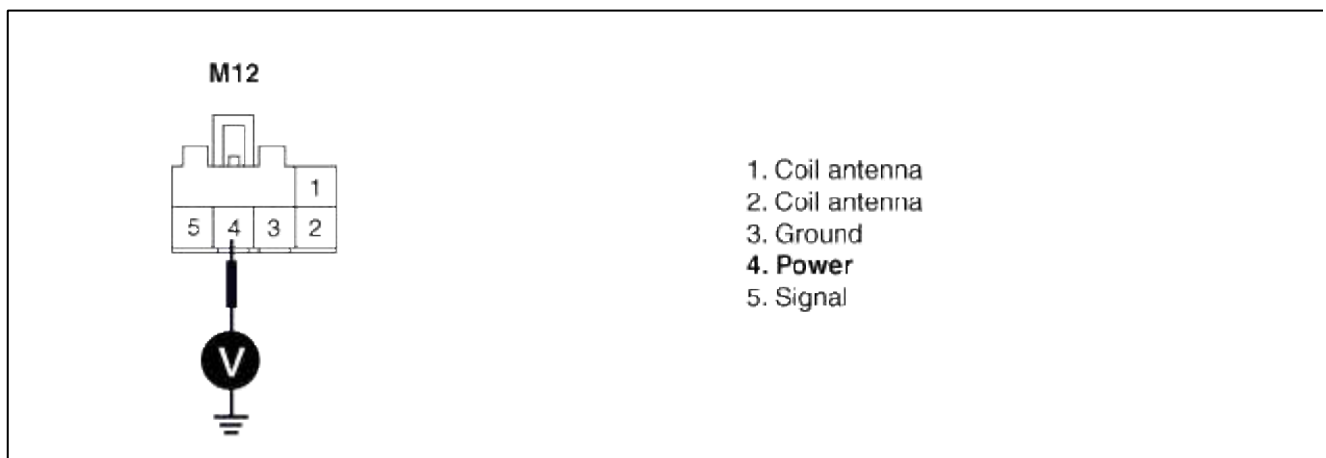
(3) Ignition "ON" & Engine "OFF"

(4) Measure voltage value between terminal "4" of SMARTRA and chassis ground.

---

Specification : 9~16V

---



(5) Is the measured voltage within specifications?

**YES**

Go to "Signal circuit Inspection" procedure

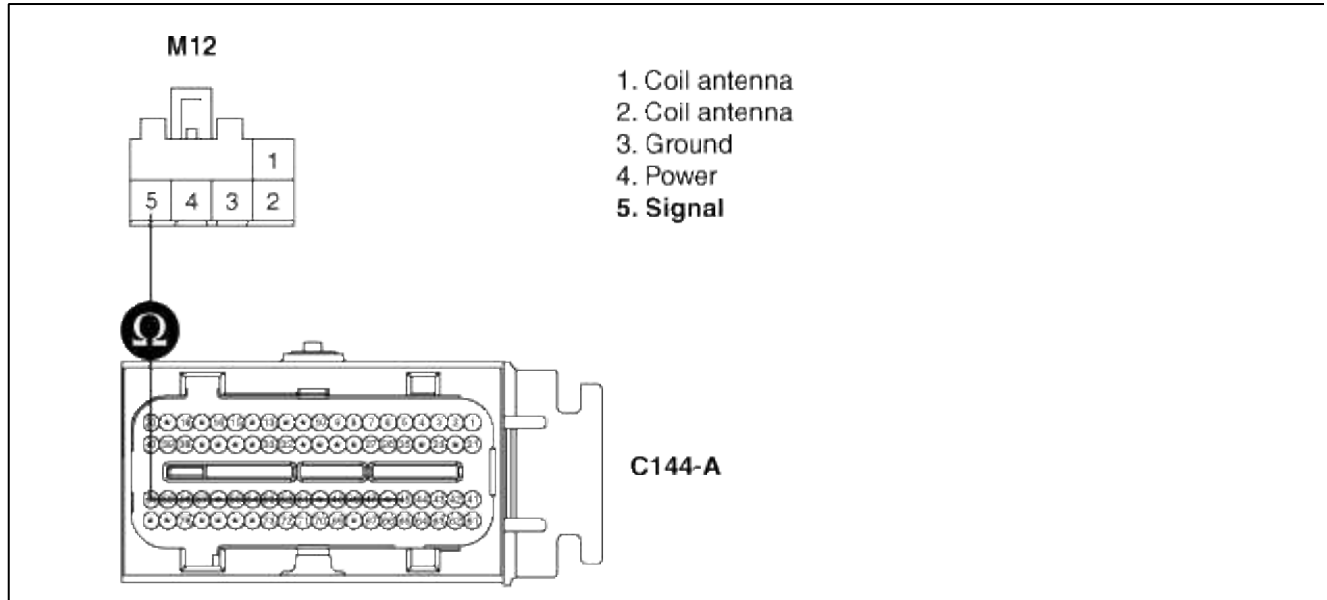
**NO**

Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness
  - (1) Ignition "OFF"
  - (2) Disconnect SMARTRA.
  - (3) Measure resistance between terminal "5" of SMARTRA and terminal C144-A-45.

Specification : 1  $\Omega$  or less



- (4) Is the measured resistance within specifications?

**YES**

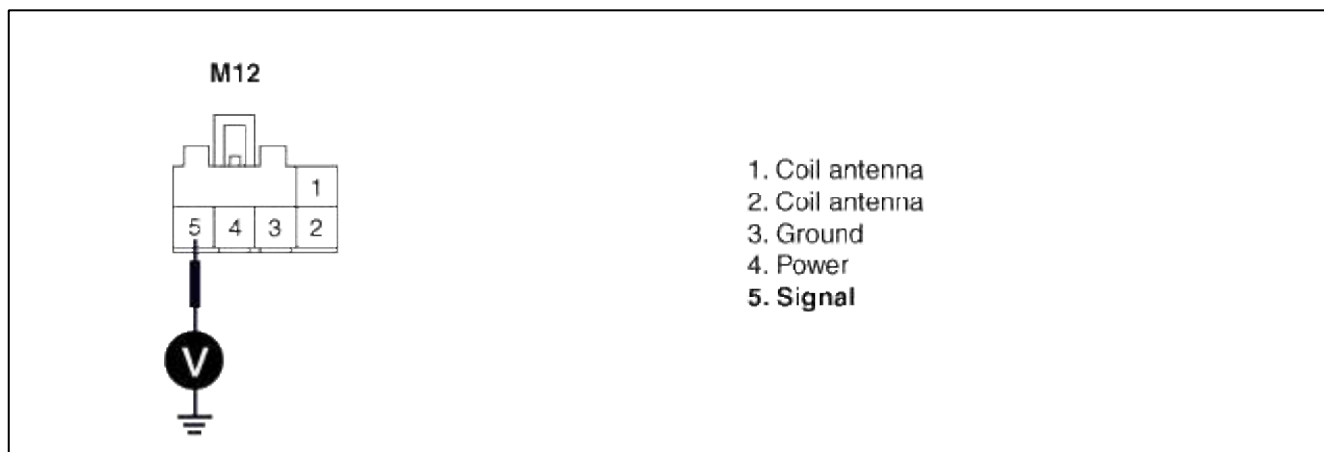
Go to "Check for short in harness" procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short in harness
  - (1) Ignition "OFF"
  - (2) Disconnect SMARTRA.
  - (3) Ignition "ON" & Engine "OFF"
  - (4) Measure voltage value between terminal "5" of SMARTRA and chassis ground.

Specification : Approx. 5.48V



(5) Is the measured voltage within specifications?

**YES**

Go to "Signal circuit Inspection" procedure

**NO**

Check for short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in ground harness

(1) Ignition "OFF"

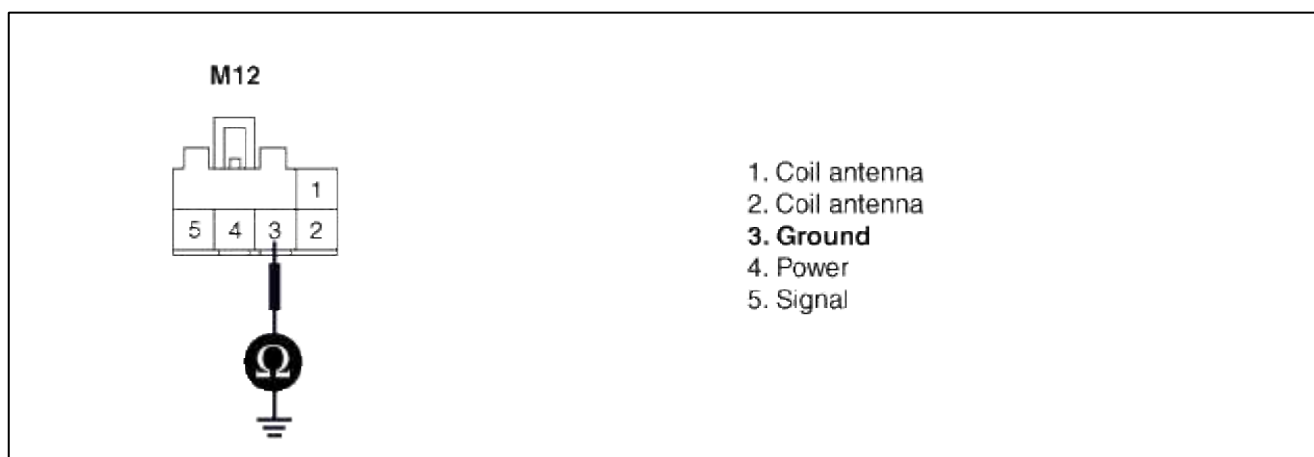
(2) Disconnect SMARTRA.

(3) Measure resistance between terminal "3" of SMARTRA and chassis ground.

---

Specification : 1  $\Omega$  or less

---



(4) Is the measured resistance within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

## Body Electrical System > Troubleshooting > P1693

### GENERAL DESCRIPTION

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer.

The transponder memory is split into two strings called authenticator and key password. After this programming, the transponder memory is locked and the data (PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt". Additionally, every transponder includes a unique IDE (Identifier number) of 32 bit.

Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.

For teaching of keys and special purposes, the ECM is connected to the tester device.

When IG is ON, the coil supplies energy to the transponder, which in turn accumulates energy in the condenser. Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

## DTC DESCRIPTION

The ECM sets DTC P1693 if there's an abnormal response from the transponder.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"> <li>Corrupted data from Transponder</li> <li>More than one TP in the magnetic field</li> <li>No TP (Key without TP) in the magnetic field</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>IG ON</li> </ul>	
Threshold value		
Detecting time		
FAIL SAFE		

## COMPONENT INSPECTION

### 1. Check transponder and ECU status

(1) IGN "ON" & Engine "OFF"

(2) Monitor the "KEY STATUS" and "ECU STATUS" Parameter on the Scantool.

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Specification : 'LEARNT'

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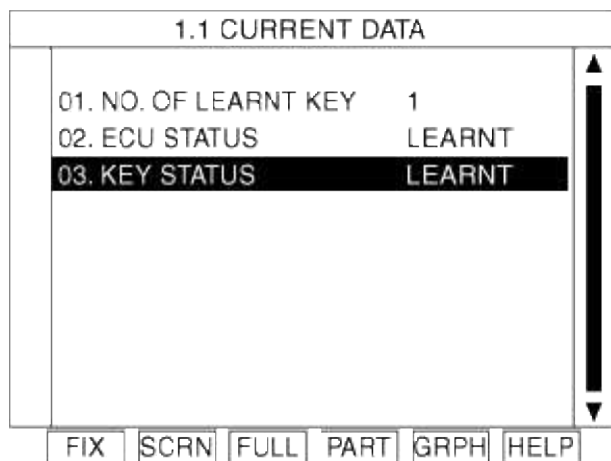


Fig 1

Fig 1) The current data in abnormal state

(3) Are "KEY STATUS" and "ECU STATUS" Parameter within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check transponder" procedure.

## 2. Check transponder

(1) IGN "ON" & Engine "OFF"

(2) Neutralize ECM and Register transponder key by scantool.

### NOTE

Pin code is required to Neutralize ECM and to Register transponder key

(3) Are Neutralizing and Registering completed normally?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good transponder and check for proper operation.

If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.

2. Operate the vehicle and monitor the DTC on the scantool.

3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

## GENERAL DESCRIPTION

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).

The immobilizer data are stored by three independent entries.

The data from EEPROM are evaluated by „2 of 3 decision“. That means all three entries are read and the content is compared before authentication process.

If the contents of all entries are equal, the authentication will run without additional measures.

If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective" is stored at ECM.

If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective" will be stored. The limp home function cannot be activated. The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

## DTC DESCRIPTION

The ECM sets DTC P1694 if there's any fault in EMS internal permanent memory (EEPROM or Flash etc.)

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy		• Faulty EMS
Enable Conditions	• IG ON	
Threshold value		
Detecting time		
FAIL SAFE		

## COMPONENT INSPECTION

1. Check transponder and ECU status
  - (1) IGN "ON" & Engine "OFF"

(2) Monitor the "KEY STATUS" and "ECU STATUS" Parameter on the Scantool.

Specification : 'LEARNT'

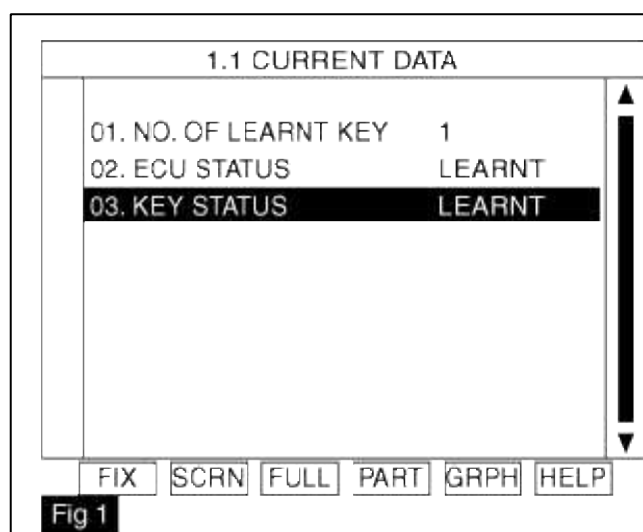


Fig 1) The current data in abnormal state

(3) Are "KEY STATUS" and "ECU STATUS" Parameter within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check transponder" procedure

## 2. Check ECM

(1) IGN "ON" & Engine "OFF"

(2) Neutralize ECM and Register transponder key by scantool.

### NOTE

Pin code is required to Neutralize ECM and to Register transponder key

(3) Are Neutralizing and Registering completed normally?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good ECM and check for proper operation.

If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

### NOTE

ECM substituted for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize ECM and to Register transponder key

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.

2. Operate the vehicle and monitor the DTC on the scantool.

3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

## Body Electrical System > Troubleshooting > P1696

### GENERAL DESCRIPTION

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer. The transponder memory is split into two strings called authenticator and key password. After this programming the transponder memory is locked and the data (PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt". Additionally every transponder includes a unique IDE (Identifier number) of 32 bit.

Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.

For teaching of keys and special purposes the ECM is connected to the tester device.

When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser.

Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

### DTC DESCRIPTION

The ECM sets DTC P1696 if invalid key is inserted into key hole for Authentication.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Virgin TP at EMS status "Learnt"</li> <li>• Learnt(Invalid) TP at EMS status "Learnt"</li> </ul>
Enable Conditions	• IG ON	
Threshold value		
Detecting time		
FAIL SAFE		

### COMPONENT INSPECTION



## 1. Check transponder and ECU status

(1) IGN "ON" &amp; Engine "OFF"

(2) Monitor the "KEY STATUS" and "ECU STATUS" Parameter on the Scantool.

Specification : 'LEARNT'

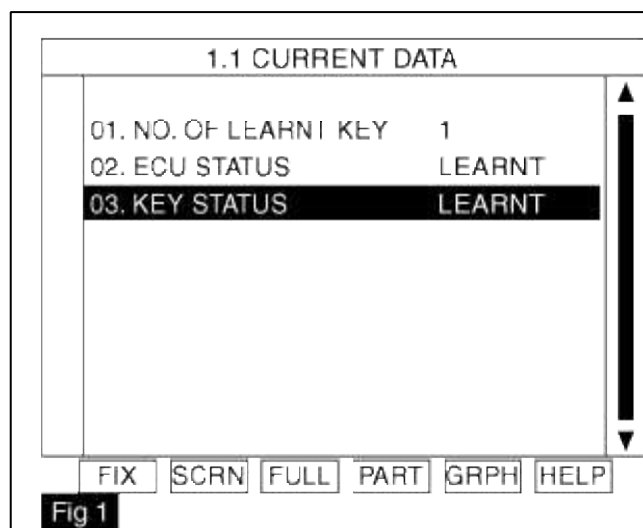


Fig 1

Fig 1) The current data in abnormal state

(3) Are "KEY STATUS" and "ECU STATUS" Parameter within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Register as necessary and then go to "Verification of Vehicle Repair" procedure.

CASE 1. KEY STATUS "VIRGIN" : Register transponder key now inserted

CASE 2. KEY STATUS "INVALID" : Register all transponder key

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

**Body Electrical System > Troubleshooting > P1697**

## GENERAL DESCRIPTION

In immobilizer system, scantool is mainly used for diagnosis. Besides this, registration of key and neutralization of ECM is executed by scantool. For ECM communicate with other components such as SMARTRA and scantool by changing type of communication through just one line, K-line communication between scantool and ECM is unavailable while communication between ECM and SMARTRA is in progress.

**DTC DESCRIPTION**

The ECM sets DTC P1696 if Request from Tester is Invalid.

**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"> <li>Invalid request               <ul style="list-style-type: none"> <li>Protocol layer violation</li> <li>Check sum error</li> </ul> </li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>IG ON</li> </ul>	
Threshold value		
Detecting time		
FAIL SAFE		

**MONITOR DTC STATUS**

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Diagnostic Trouble Codes(DTCs)" mode and monitor "DTC Status" parameter
4. Is the DTC B1697 present?

**YES**

Go to "Inspection & Repair" procedure.

**NO**

Fault is intermittent caused by poor contact in SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**COMPONENT INSPECTION**

1. Check communication between ECM and scantool
  - (1) IGN "ON" & Engine "OFF"
  - (2) Connect scantool to Data Link Connector(DLC).

(3) Erase the DTC and Monitor Parameter of immobilizer on the Scantool.

Try one more time from "select car model " even if "Communication error" is present on the scantool.

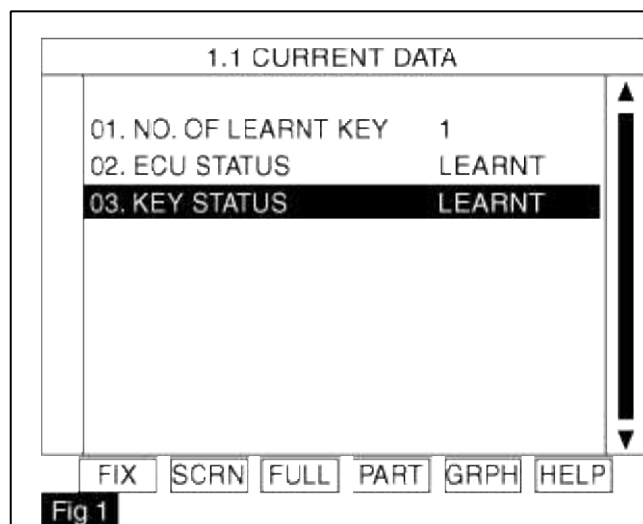


Fig 1) The current data in abnormal state

(4) Is the communication between ECM and scantool normal?

**YES**

If ECM is in "Locked by Timer" status. Keep "KEY ON" status for 1 hours to withdraw "Locked by Timer" s  
Then repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good scantool and check for proper operation.

If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

## Body Electrical System > Troubleshooting > P1698

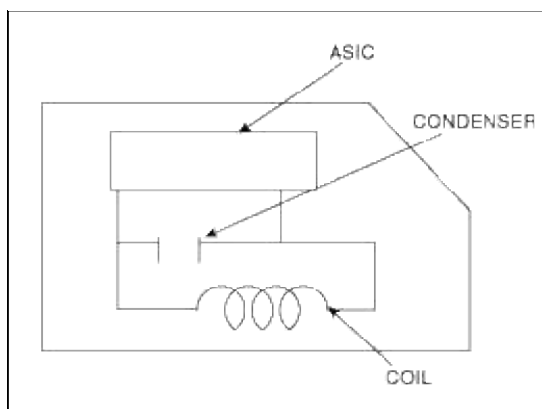
### GENERAL DESCRIPTION

A transponder is incorporated in the head section of the key. The antenna coil supplies energy to the transponder. The transponder accumulates energy in the condenser. Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

When Ignition is set 'ON' the ICM receives a request signal from the ECM and starts ID Code registering sequence. If the ID code format from the transponder is not correct, the ICM repeatedly performs the registering sequence. When the correct ID code format is registered, the code is verified by the ICM.

If the code is not verified, the registering sequence is repeated a maximum of 5 times which is equivalent to 1 second duration.

Once the correct ID code is registered and verified after Ignition is turned ON, the registering sequence is not reperformed until Ignition is turned OFF.



## DTC DESCRIPTION

This DTC is defined as Invalid(virgin or invalid) Transponder Data.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty TP(Virgin or Invalid)
Detecting factors	• Invalid TP	
Detecting Criteria	• Virgin TP at EMS STATUS "Learnt" • Learnt(Invalid) TP at EMS status "Learnt"(Authentication fail)	

## MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF"
2. After connecting Scantool, Monitor the DTCs and CURRENT DATA to check key status.

**1.1 DIAGNOSTIC TROUBLE CODES**

**B1698 TRANSPONDER - INVALID**

NUMBER OF DTC : 1 ITEMS

PART ERAS HELP

**1.2 CURRENT DATE**

NUMBER OF LEARNT KEY	2.0
ECU STATUS	LEARNT
ICU STATE	LEARNT
<b>KEY STATUS</b>	<b>INVALID</b>

FIX SCRN FULL PART GRPH HELP

3. Are DTSs and CURRENT DATA displayed as above?

**YES**

If key status is "invalid" is displayed, check transponder(key) and then go to "Verification of Vehicle Repair" procedure.

**NOTE**

1. Be sure that P1698 is displayed, when transponder(key) is unintentionally exchanged with another key.
2. Be sure that P 1698 is displayed, when using virgin transponder(key) with learnt ICU.
3. Be sure that P1698 is displayed by arbnormal stop when key theaching is performed by learnt key(with same PIN code)

**NO**

Fault is intermittent caused by poor contact in the ICU and/or the antenna coil connector or was repaired and ICU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

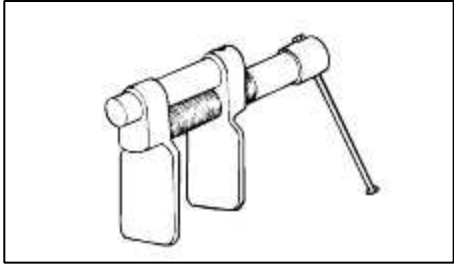
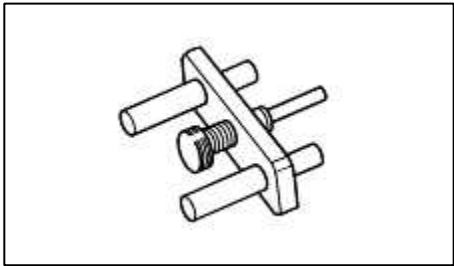
**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

**SORENTO(BL) > 2007 > G 3.3 DOHC > Brake System****Brake System > General Information > Special Service Tools****SPECIAL SERVICE TOOLS**

<b>Tool (Number and Name)</b>	<b>Illustration</b>	<b>Usage</b>
09581 - 11000 Piston expander		Pushing back of the front disc and rear disc brake piston
0K993 430 032 Adjustment gauge		Used to adjust push rod gap

**Brake System > General Information > Troubleshooting****TROUBLESHOOTING**

<b>Trouble symptom</b>	<b>Possible cause</b>	<b>Remedy</b>
Noise or vibration when brakes are applied	Caliper improperly mounted Loose caliper mounting bolts Unevenly worn or cracked brake drum or brake disc Foreign material in brake drum Seized pad or lining contact surface Excessive clearance between pad assembly and caliper Uneven pad contact Lack of lubrication in sliding parts Loose suspension parts Excessive of disc runout Excessive variation of disc thickness	Correct Retighten Replace Clean Replace Correct Correct Lubricate Retighten Correct the runout Replace disc
Vehicle pulls to one side when brakes are applied	Difference in left and right tire inflation pressure Inadequate contact of pad Grease or oil on pad surface Incorrect wheel cylinder installation	Adjust Correct Replace Correct
Insufficient braking power	Low or deteriorated brake fluid Air in the brake system Brake booster malfunction Inadequate contact of pad	Refill or change Bleed the system Correct Correct

Grease or oil on pad surface	Replace
Overheated brake rotor due to dragging of pad	Correct
Clogged brake line	Replace
Proportioning valve malfunction	Replace

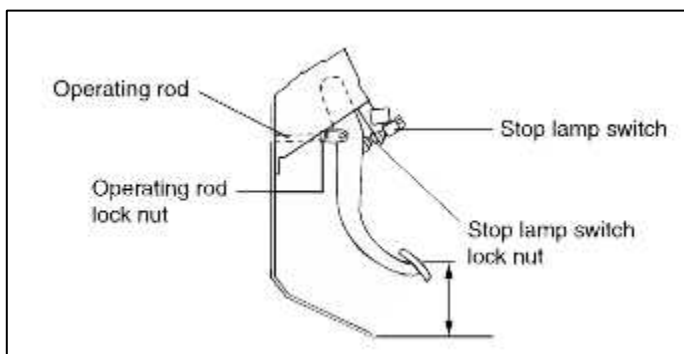
## Brake System > General Information > Repair procedures

### SERVICE ADJUSTMENT PROCEDURES

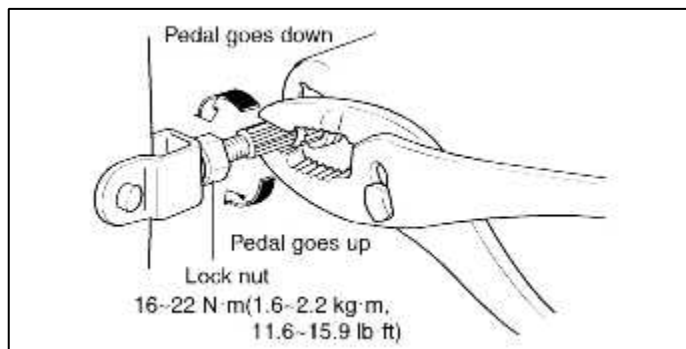
#### INSPECTION AND ADJUSTMENT

1. Measure the brake pedal height. If the brake pedal height is not within the standard value, adjust as follows.

Standard value :  
200 mm (7.87 in.)

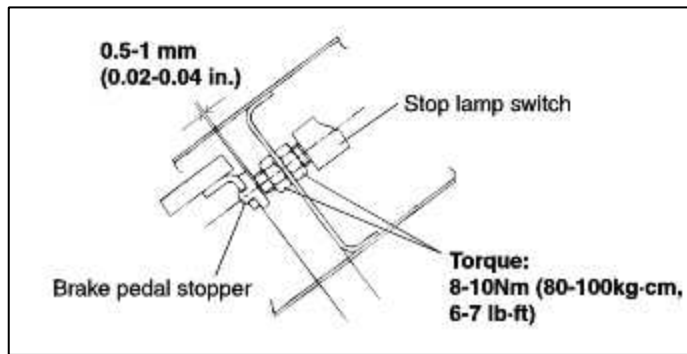


- (1) Disconnect the stop lamp switch connector, loosen the lock nut, and move the stop lamp switch to a position where it does not contact the brake pedal arm.
- (2) Adjust the brake pedal height by turning the operating rod with pliers (with the operating rod lock nut loosened), until the correct brake pedal height is obtained.



- (3) After turning the stop lamp switch until it contacts the brake pedal stopper (just before the brake pedal is caused to move), return the stop lamp switch 1/2 to 1 turn and secure by tightening the lock nut.
- (4) Connect the connector of the stop lamp switch.

(5) Check that the stop lamp is not illuminated with the brake pedal unpressed.



2. With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal down by hand, and confirm that the amount of movement before resistance is met (the free play) is within the standard value.

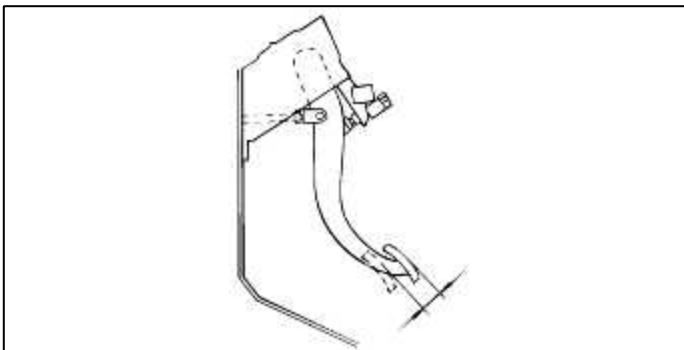
Standard value

4 - 7 mm (0.157 - 0.275 in.)

If free play does not reach the standard value, check that clearance between the outer case of stop light switch and brake pedal is within the standard value.

If free play exceeds the standard value, it is probably due to excessive clearance between the clevis pin and brake pedal arm.

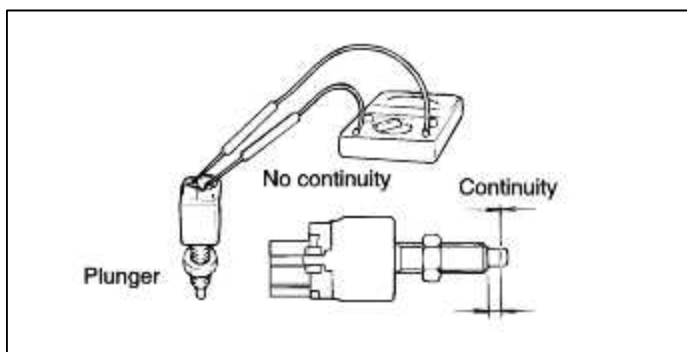
Check for excessive clearance and replace faulty parts as required.



3. Start the engine, depress the brake pedal with approximately 120kgf of force, and check for oil leakage in the master cylinder, brake line and each connecting part.

Repair the faulty parts as required.

#### STOP LAMP SWITCH INSPECTION

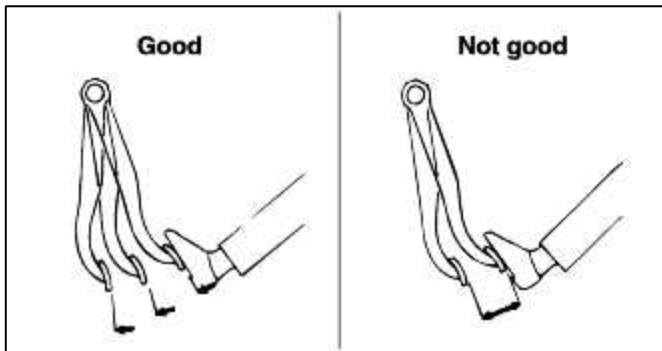


#### BRAKE BOOSTER OPERATING TEST



1. Run the engine for one or two minutes, and then stop it.

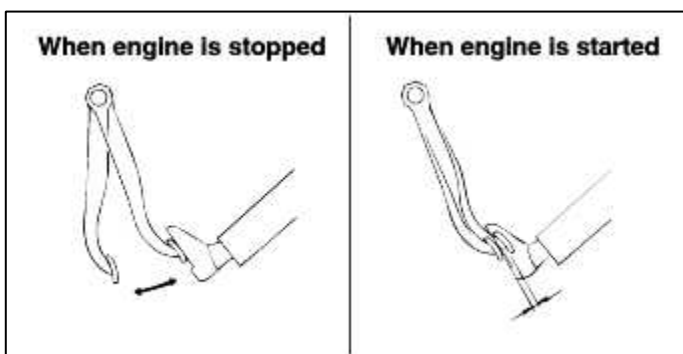
If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is defective.



2. With the engine stopped, step on the brake pedal several times.

Then step on the brake pedal and start the engine.

If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.

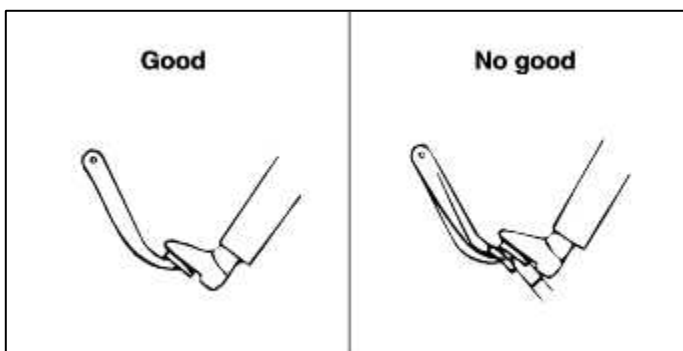


3. With the engine running, step on the brake pedal and then stop the engine.

Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective.

If the above three tests are okay, the booster performance can be determined as good.

Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for defect.



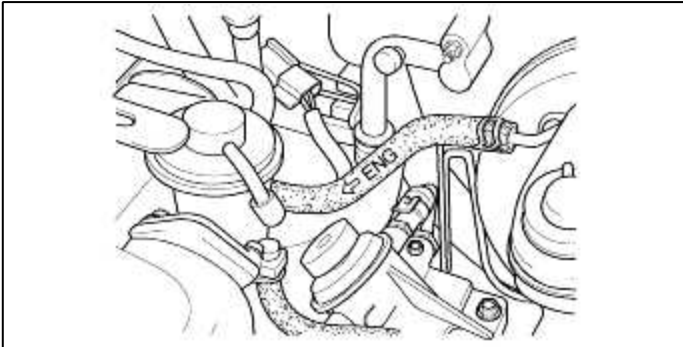
## CHECK VALVE INSPECTION

1. Disconnect the vacuum hose.

2. Check to be sure that air passes to the engine and not from the engine when air is taken in from the power-brake unit side of the vacuum hose.

**NOTE**

- The check valve is pressed into the vacuum hose, and there is an arrow on the hose surface to indicate the installation direction.

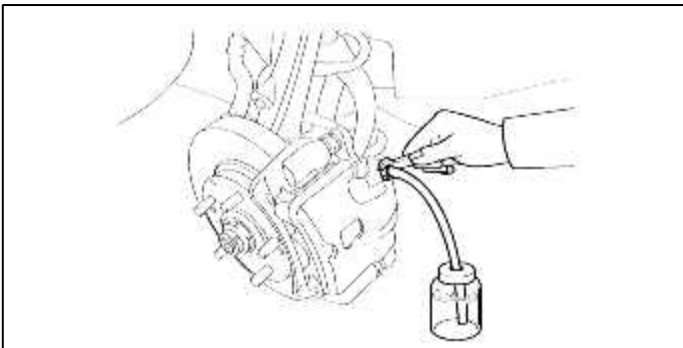
**BLEEDING OF BRAKE SYSTEM**

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

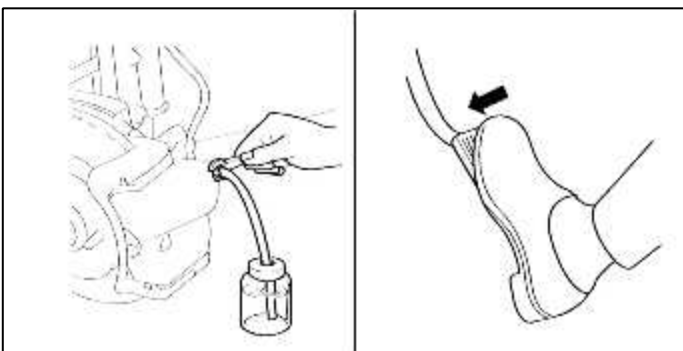
**CAUTION**

- Do not allow brake fluid to remain on a painted surface. Wash it off immediately.
- Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

2. Connect a vinyl tube to the wheel cylinder bleeder screw and insert the other end of the tube in a container of brake fluid which is half full.



3. Start the engine.
4. Slowly depress the brake pedal several times.
5. While depressing the brake pedal fully, loosen the bleeder screw until fluid runs out. Then close the bleeder screw and release the brake pedal.

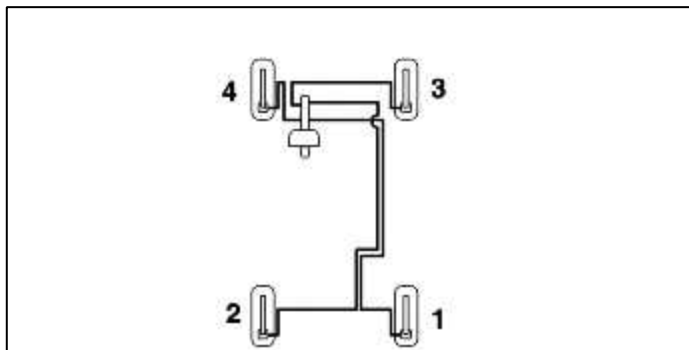


6. Repeat steps 4 and 5 until there are no more bubbles in the fluid.

7. Tighten the bleeder screw.

7 - 9 N·m (70-90 kg·cm, 5-6.6 lb·ft)

8. Repeat the above procedure for each wheel in the sequence shown in the illustration.



## Brake System > General Information > Specifications

### GENERAL

#### SPECIFICATION (ABS)

Part	Item		Standard value	Remark
HECU(Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor (Solenoid)	·ABS system:ABS & EBD control
	Type		Motor, valve relay intergrated type	
	Operating voltage		8 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 120 °C (-40 ~ 248 °F)	
Warning lamp	Operating voltage		12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, brake oil, EBD failure
	Current consumption		80 mA	
Acitve wheel speed sensor	Supply voltage		DC 4.5 ~ 2.0 V	
	Operating temperature		-40 ~ 150 °C (-40 ~ 302 °F)	
	Output current low		5.9 ~ 8.4 mA	Typ.7 mA
	Output current High		11.8 ~ 16.8 mA	Typ.14 mA
	Frequency range		1 ~ 2500 HZ	
	Air gap	Front	0.4 ~ 1.0 mm (0.02 ~ 0.04 in)	Typ.0.7 mm(0.03 in)
		Rear	0.4 ~ 1.0 mm (0.02 ~ 0.04 in)	Typ.0.7 mm(0.03 in)
	Tone wheel		48 teeth	
	Output duty		30~70 %	

**SPECIFICATION(VDC)**

Part	Item		Standard Value	Remark
HECU(Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor(Solenoid)	·Total control(ABS, EBD, TCS, ESC)
	Type		Motor, valve relay intergrated type	
	Operating voltage		8 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 120 °C (-40 ~ 248 °F)	
Warning lamp	Operating voltage		12 V	·ESC Operating Lamp ·ESC Warning Lamp
	Current consumption		80 mA	
Active wheel speed sensor	Supply voltage		DC 4.5 ~ 20V	
	Operating temperature		-40 ~ 150 °C (-40 ~ 302 °F)	
	Output current low		5.9 ~ 8.4 mA	
	Output current high		11.8 ~ 16.8 mA	
	Tone wheel		48 teeth	
	Frequency range		1 ~ 2500 HZ	
	Airgap	Front	0.4 ~ 1.0 mm (0.02 ~ 0.04 in)	Typ. 0.7 mm(0.03 in)
		Rear	0.4 ~ 1.0 mm (0.02 ~ 0.04 in)	Typ. 0.7 mm(0.03 in)
Steering Wheel Angle Sensor	Operating Voltage		8V ~ 16 V	
	Current Consumption		Max 150 mA	
	Operating Angular velocity		Max ± 780 °/sec	
Yaw-rate & Lateral G sensor	Operating Voltage		8 V ~ 16 V	
	Current Consumption		Max. 120 mA	
	Output Voltage high		4.35 V~ 4.65 V	Typ. 4.5 V
	Output Voltage low		0.35 ~ 0.65 V	Typ. 0.5 V
	Yaw Sensor Operating Range		±100 ° /s	
	G Sensor Operating Range		±1.8 G	
	Reference voltage output		2.464 ~ 2.536 V	Typ. 2.5 V

**SERVICE STANDARD**

ITEMS	SPECIFICATIONS
<b>Standard value</b>	
Brake pedal height	200 mm (7.87 in.)
Clearance between stop lamp switch outer case and pedal arm	1.5 ~ 2.0mm(0.06 ~ 0.08in.)
Brake pedal free play	4-7 mm (0.157 - 0.275 in.)
Parking brake lever stroke	6-8 clicks (When lever assembly is pulled with 10kgf)
<b>Service limit</b>	
Front disc brake pad thickness	2.0 mm (0.0787 in.)
Front disc thickness (minimum)	26 mm (1.02 in.)
Front disc runout	0.03 mm ( 0.0012 in.)
Front disc thickness variation	0.005 mm (0.0002 in.)
Rear disc brake pad thickness	2.0 mm (0.079 in.)
Rear disc thickness	18.4 mm (0.724 in.)
Parking brake drum I.D.	191 mm (7.52 in.)
Parking brake lining thickness	1.5 mm (0.059 in.)

## LUBRICANTS

Items	Recommended lubricant	Quantity
Brake fluid	DOT 3 or equivalent	As required
Brake pedal bushing and brake pedal bolt	Chassis grease SAE J310, NLGI No.0	As required
Joint pin	Wheel bearing grease SAE J310, NLGI No.2	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease, NLGI No.0-1	As required

## Brake System > Brake System > Description and Operation

### DESCRIPTION

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.

It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.

The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.

The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution to the rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.

EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

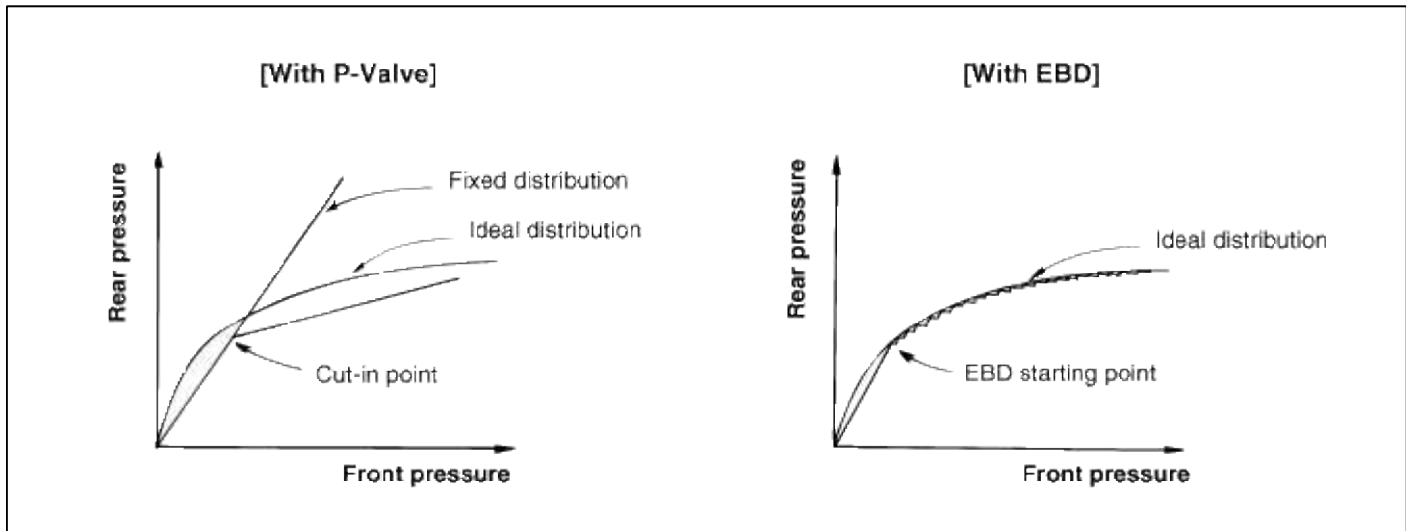
If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

### ADVANTAGES

- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.

- Failure recognition by the warning lamp.

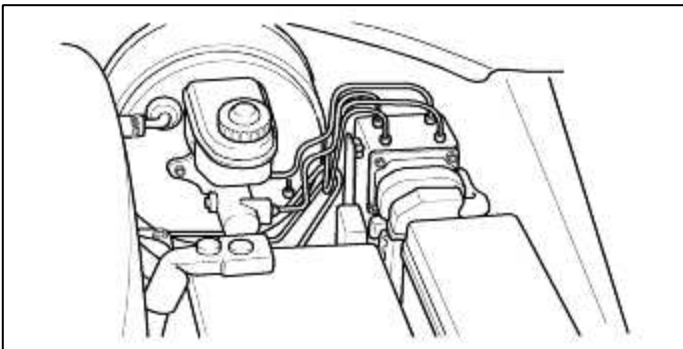
Comparison between Proportioning valve and EBD



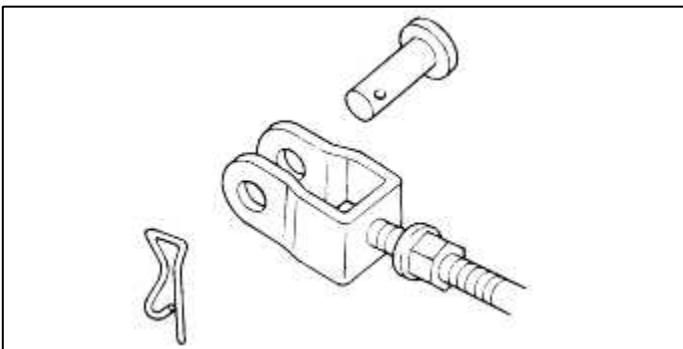
### Brake System > Brake System > Brake Booster > Repair procedures

#### REMOVAL

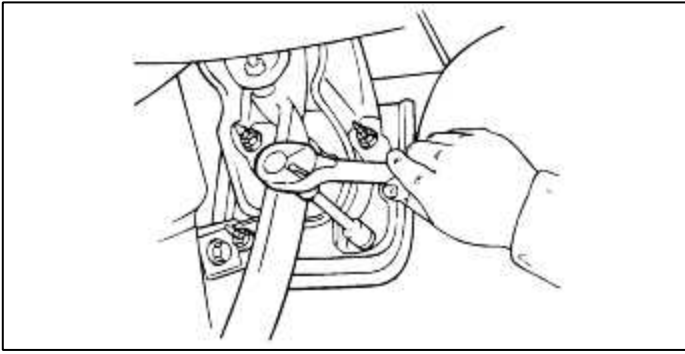
1. Remove master cylinder and gasket.
2. Disconnect vacuum hose from the booster.



3. Remove the shift knob cable (A/T) and then remove joint pin and snap pin.



4. Remove the lock nut and then remove brake booster.

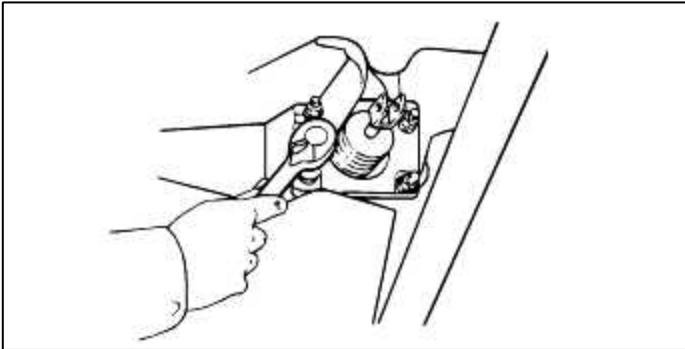


## INSTALLATION

1. When installing the booster assembly, replace the packing of each end of booster installation holder.
2. Insert the booster and tighten the nut.

Tightening torque :

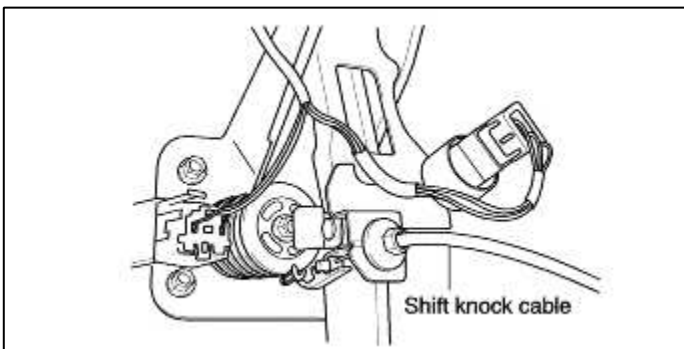
19 - 26 N·m (1.9 - 2.6 kg-m, 13 - 18 lb-ft)



3. Connect the booster push rod and brake pedal with a joint pin and install a snap pin to the joint pin and then install the shift knock cable (A/T).

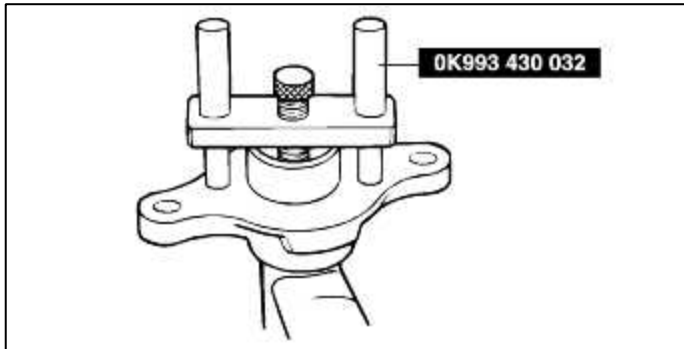
### CAUTION

When installing the snap pin, A new one must be used.

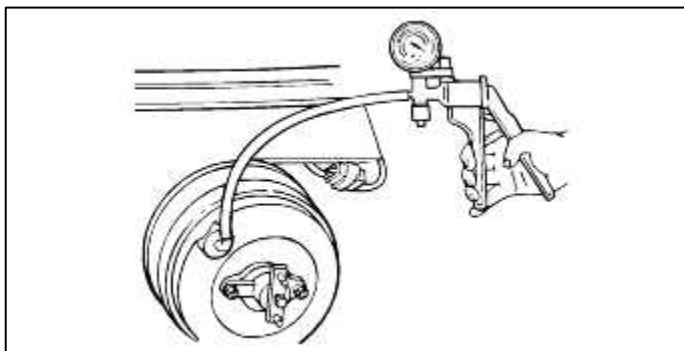


#### 4. Adjust push rod length

- (1) Insert the gasket onto the master cylinder.
- (2) Put the SST onto the gasket and tighten the adjusting bolt until the bolt touches the bottom of the push rod hole.



- (3) Apply 500 mmHg vacuum with a vacuum pump.
- (4) Invert the SST used in step 2 and place it on the booster.



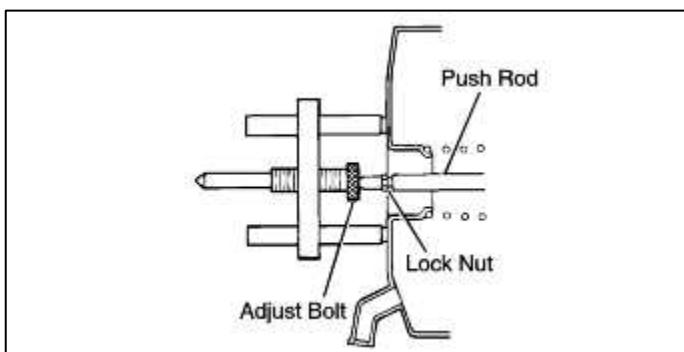
- (5) Check whether the clearance between the edge of the adjust bolt and the push rod of the booster is 1.2 - 1.7 mm (0.047 - 0.067 in.).  
If it is not 1.2 - 1.7 mm (0.047 - 0.067 in.), loosen the lock nut of the push rod, and turn the push rod to make the adjustment.

---

Permissible play :

1.2 - 1.7 mm (0.047 - 0.067 in.)

---



#### 5. Install the master cylinder.

---

Tightening torque :

10-16 Nm (1.0-1.6 kg-m, 7-11 lb-ft)

---

6. Connect the vacuum hose to the brake booster.
7. After filling the brake reservoir with brake fluid, bleed the system.
8. Check for fluid leakage.



9. Check and adjust the brake pedal for proper operation.
10. After installing, apply grease to the contact parts of the joint pin and brake pedal.

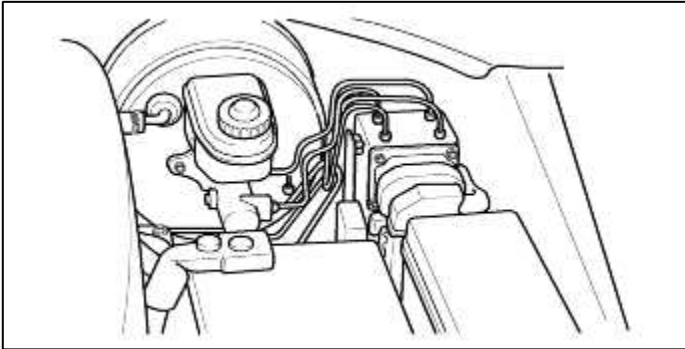
## Brake System > Brake System > Master Cylinder > Repair procedures

### REMOVAL

1. Detach the brake tubes from the master cylinder, and then install the plug.

#### CAUTION

Do not allow brake fluid to remain on a painted surface. Wash it off immediately.



2. Remove the master cylinder mounting nuts and then remove the master cylinder.

### INSTALLATION

1. Install the master cylinder on the brake booster with 2 nuts.

Tightening torque

Master cylinder installation nut :

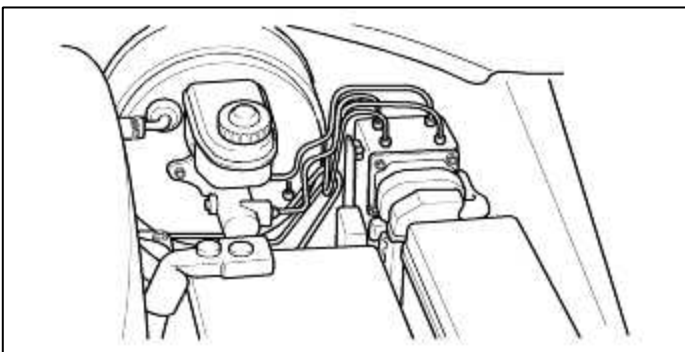
10-16 Nm (100-160 kg·cm, 7-11 lb·ft)

2. Connect 2 brake tubes and the brake fluid level warning connector.

Tightening torque

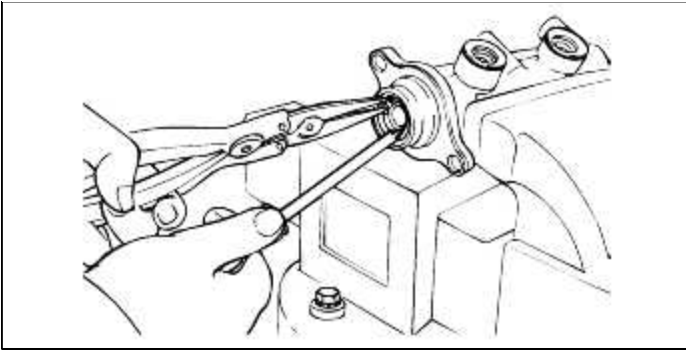
Brake tube flare nut :

13-22 (130-220 kg·cm, 9.5-15 in.)



### DISASSEMBLY

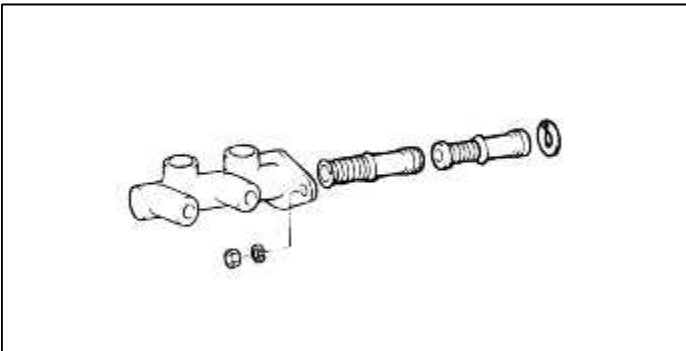
1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the reservoir from the master cylinder.
3. Using a snap ring pliers, remove the retainer ring.



1. Remove the bolt with the primary piston pushed completely using a screwdriver. Remove the primary piston assembly.
2. Remove the bolt with the secondary piston pushed completely using a screwdriver. Remove the secondary piston assembly.

#### NOTE

Do not disassemble the primary and secondary piston assembly.



### INSPECTION

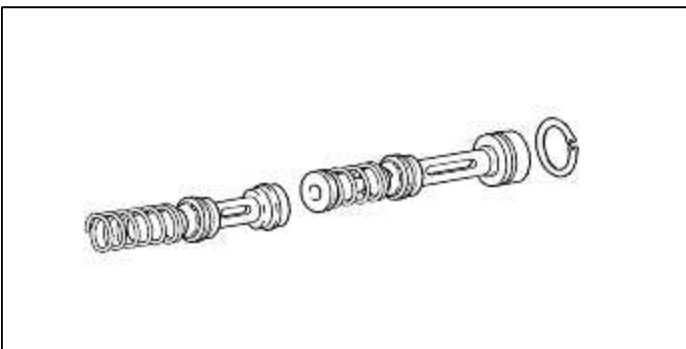
1. Check the master cylinder bore for rust or scratch.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

#### CAUTION

1. If the cylinder bore is damaged, replace the master cylinder assembly.
2. Wash the contaminated parts in alcohol.

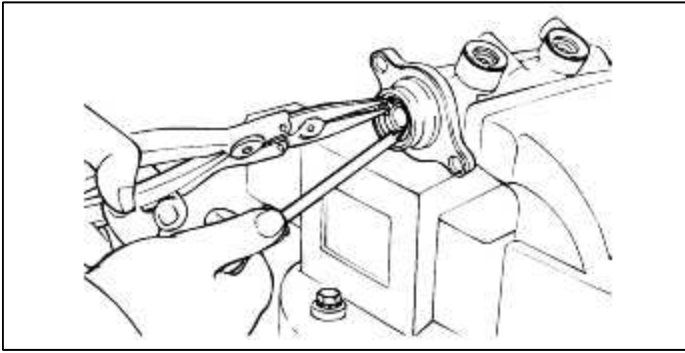
### REASSEMBLY

1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.



1. Carefully insert the springs and pistons in the proper direction.

2. Press the piston with a screwdriver and install the retainer ring.



1. With the piston pushed completely by a screwdriver, install the bolt.

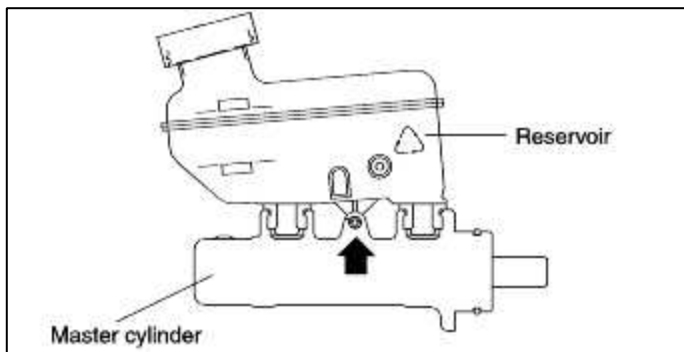
Tightening torque :

7-10 N·m (0.7-1.0 kg-m, 5-7 lb-ft)

2. Mount two grommets.
3. Install the reservoir on the cylinder.

Tightening torque :

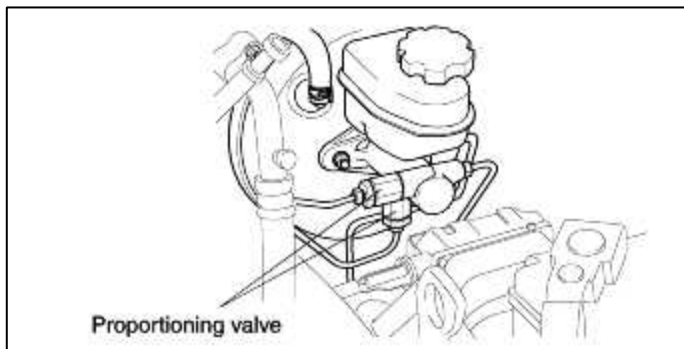
1-1.5 N·m (0.1-0.15 kg-m, 0.7-1.0 lb-ft)



### Brake System > Brake System > Proportioning Valve > Repair procedures

#### INSPECTION

1. Connect the two oil pressure gauges 9810 kPa (100 kg/cm<sup>2</sup>, 1422 psi) to the outlet valve of front and rear brake.



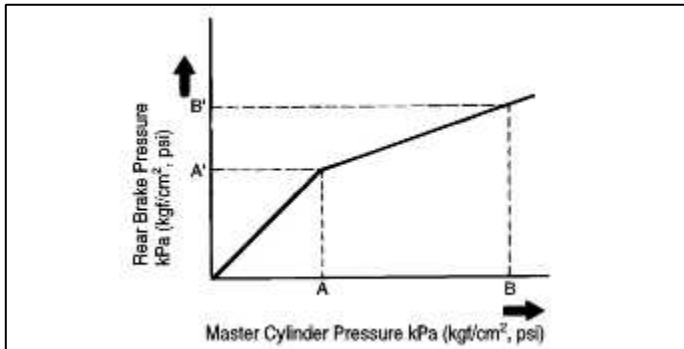
2. Bleed the air from the brake system.
3. Depress the brake pedal until the front brake pressure equal to A; then record rear brake pressure A'.

4. Depress the brake pedal again, and apply additional pressure until the pressure equal to B; then record pressure B'.

#### SPECIFICATIONS (DYNAMIC CONDITION)

Slope ( $\tan \theta$ )	Split point
11.3	26 bar

Front brake pressure	Rear brake pressure
A:26(369.8)	A':26(369.8)
B:80(1137.8)	B':40(568.9)



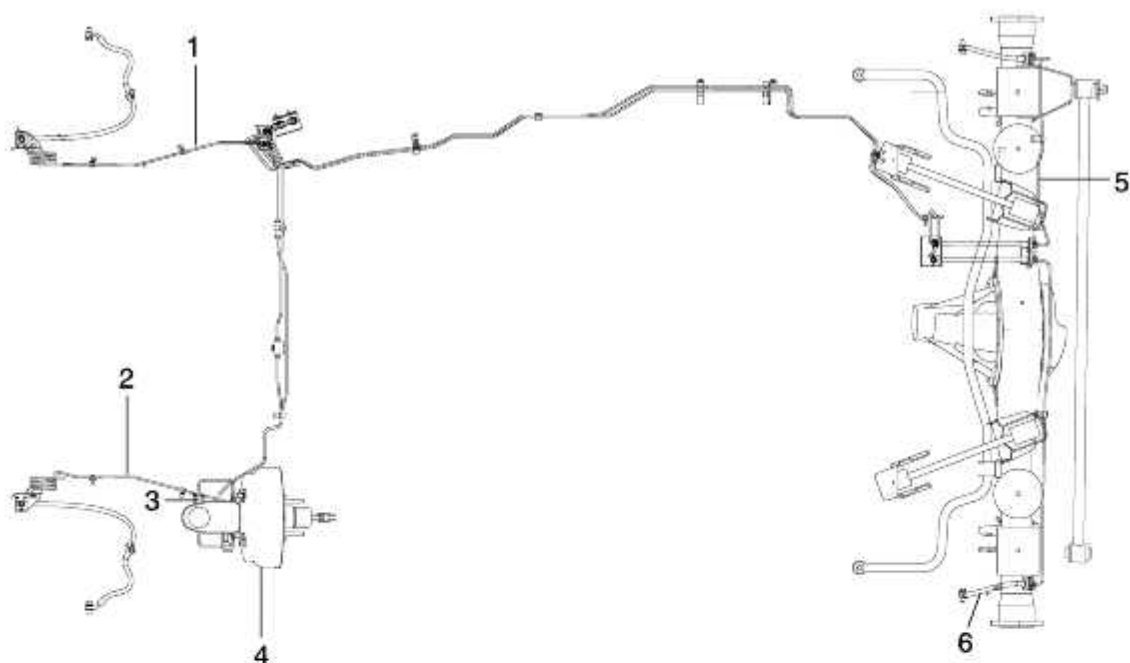
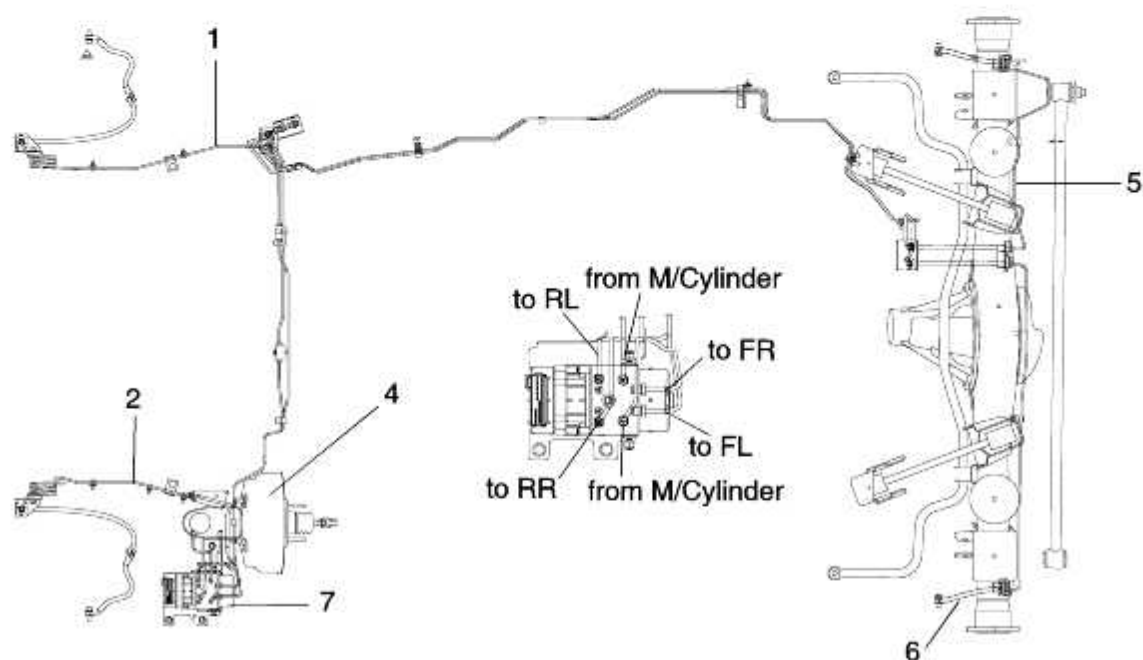
5. If the test value exceeds standard value, replace the proportioning valve.

Tightening torque

35-55 N·m (3.5-5.5 kg-m, 25-40 lb-ft)

#### Brake System > Brake System > Brake Line > Components and Components Location

#### COMPONENTS

**<CBS>****<ABS>**

- 1. Brake hose & pipe (FR)
- 2. Brake hose & pipe (FL)
- 3. Proportioning valve
- 4. Booster & master cylinder assembly

- 5. Brake hose & pipe (RR)
- 6. Brake hose & pipe (RL)
- 7. Hydraulic control unit

## Brake System > Brake System > Brake Line > Repair procedures

### REMOVAL

### INSTALLATION

1. Install the brake hoses without twisting them.

**CAUTION**

When installing, be sure the brake hose does not contact edges, welding or moving parts.

2. Tighten to the specified torque as follows.

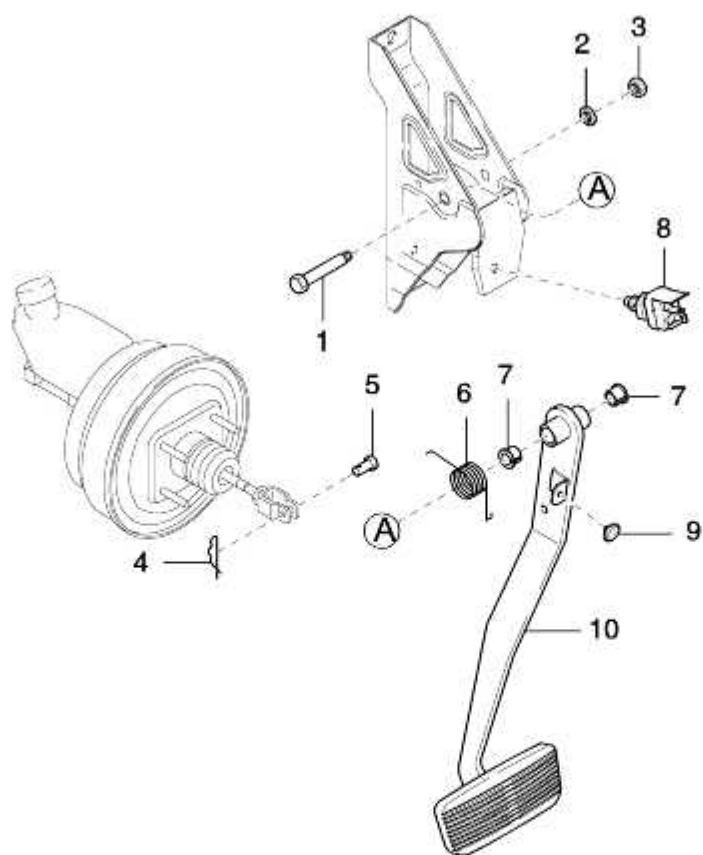
Items	Torque N·m (kg-m, lb-ft)
Brake flare nut and brake hose	13 - 22 (1.3-2.2, 9-15)
Brake hose and caliper	17 - 20 (1.7-2.0, 12-14)
Air bleed screw	7 - 9 (0.7-0.9, 5-7)

## INSPECTION

- Check the brake tubes for cracks, crimps and corrosion.
- Check the brake hoses for cracks, damaged and oil leakage.
- Check the brake tube flare nuts for damage and oil leakage.

## Brake System > Brake System > Brake Pedal > Components and Components Location

## COMPONENTS



1. Bolt

2. Spring washer

3. Nut

4. Snap pin

5. Joint pin

6. Return spring

7. Bushing

8. Stop lamp switch

9. Rubber stopper

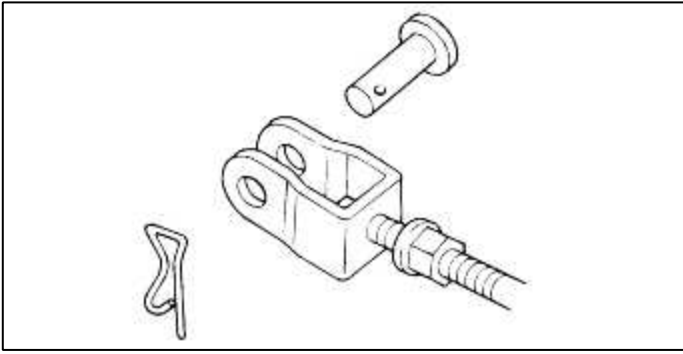
10. Brake pedal

### Brake System > Brake System > Brake Pedal > Repair procedures

#### REMOVAL

1. Remove the stop lamp switch connector.

2. Remove the joint pin and snap pin.



3. Remove the nut and then remove the brake pedal.

## INSTALLATION

1. Installation is the reverse of removal.

Nut tightening torque :

20-35 N·m (2.0-3.5 kg-m, 14-25 lb-ft)

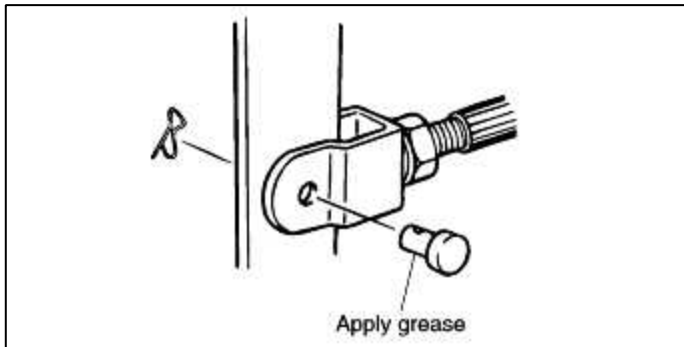
### CAUTION

Coat the inner surface of the bushings with the specified grease.

Specified grease :

Chassis grease LiG-2

2. Before inserting the joint pin, apply the specified grease to the joint pin.



## INSPECTION

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.
4. Check all parts for crack and wear.

## Brake System > Brake System > Front Disc Brake > Repair procedures

### INSPECTION AND REPLACEMENT OF FRONT DISC BRAKE PAD

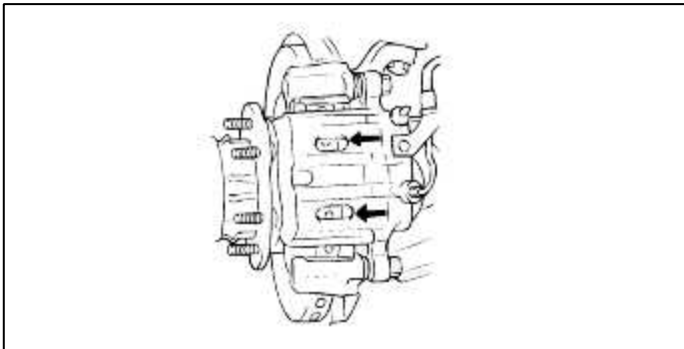


1. Check the brake pad thickness through the caliper body inspection hole.

Pad lining thickness

Standard value : 10.5 mm (0.413 in.)

Service limit : 2.0 mm (0.0787 in.)



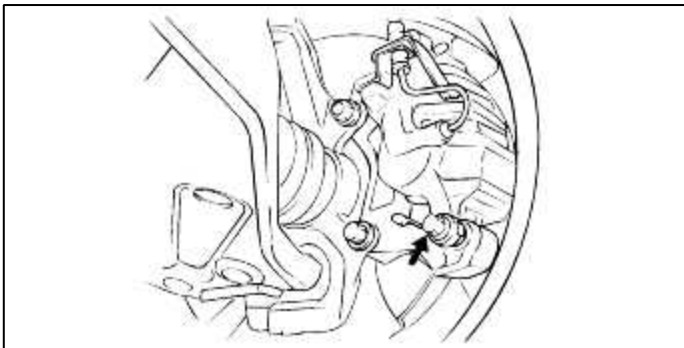
**CAUTION**

1. If the pad lining thickness is out of specification, left and right pads must be replaced as a complete set.
2. When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston, the lock pin and the guide pin.

2. Remove the guide pin, lift the caliper assembly up and suspend it with a wire.

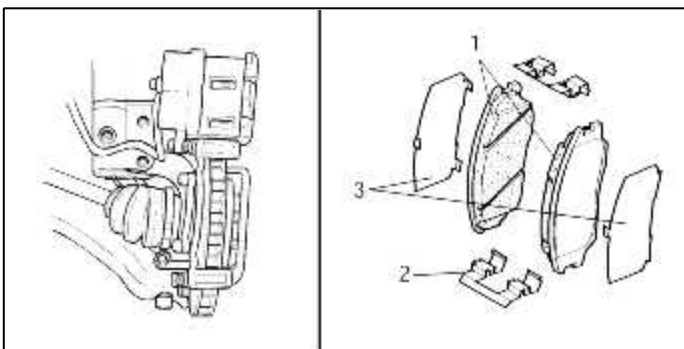
**CAUTION**

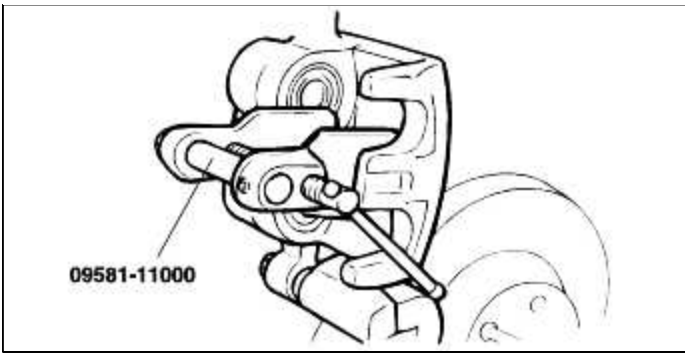
Be careful not to contaminate the lock pin and guide pin with grease.



3. Remove the following parts from the caliper support.

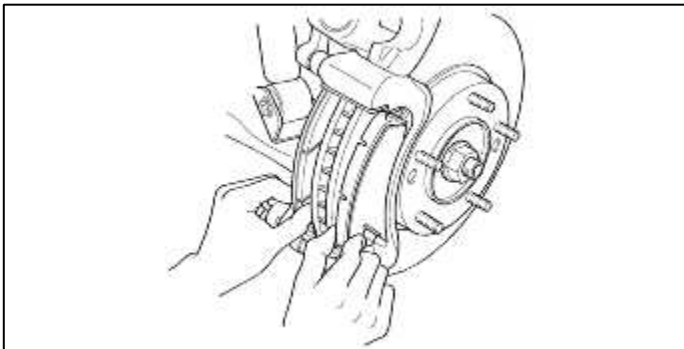
- A. Pad and wear sensor assembly
- B. Pad spring
- C. Outer shim





## INSTALLATION

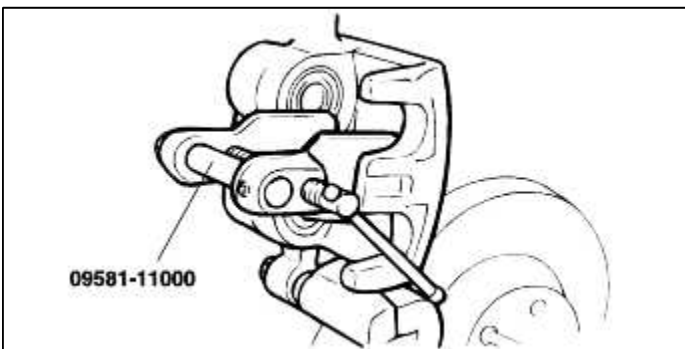
1. Install the pad clips.
2. Install the pads on each pad clip.



### CAUTION

1. All four pads must be replaced as a complete set.
2. When replacing the brake pads, check for deformation. When replacing the guide spring, use a new one or thoroughly clean the used one.

3. Press-fit the piston with a hammer handle or the special tool (09581-11000).



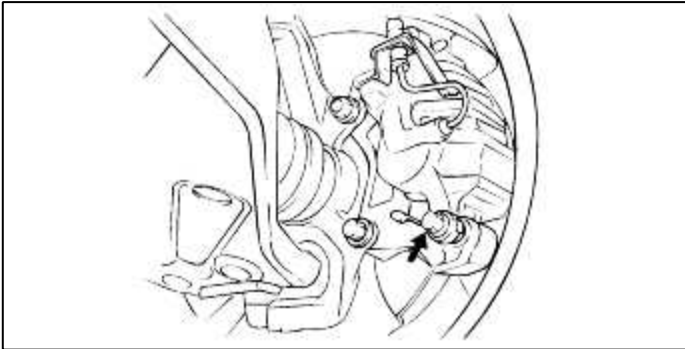
1. Lower and insert the brake cylinder carefully so as not to damage the boot.

2. Tighten the two guide rod bolts to the specified torque.

Tightening torque

Guide rod bolt :

22 - 32 Nm (220 - 320 kg·cm, 16 - 24 lb·ft)



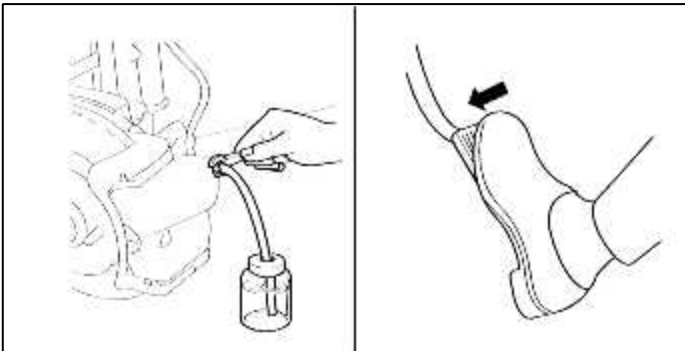
## INSTALLATION

1. Install the pads and brake cylinder.
2. Install the brake hose to the caliper.

Tightening torque

17-20 Nm (170-200 kg·cm, 12-14 lb·ft)

3. Fill the brake reservoir with brake fluid.
4. Bleed the system.



## DISASSEMBLY

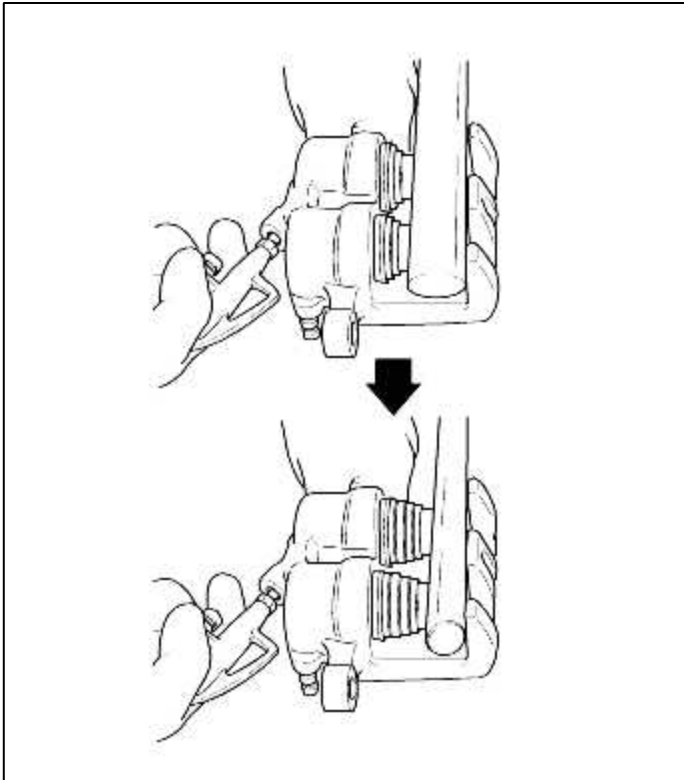
Front disc brakes should be disassembled separately into the left and right as a set.

1. Remove the piston boot/piston. Blow compressed air into the brake hose seating hole so as to remove the piston and the piston boot.

**NOTE**

When removing the piston, blow air slowly, adjusting the heights of the two pistons to push them out equally.

The secondary piston should not be removed before the primary piston is removed completely. Otherwise the secondary piston can't be removed.



2. Remove the piston seal.

(1) Remove the piston seal with your finger.

**CAUTION**

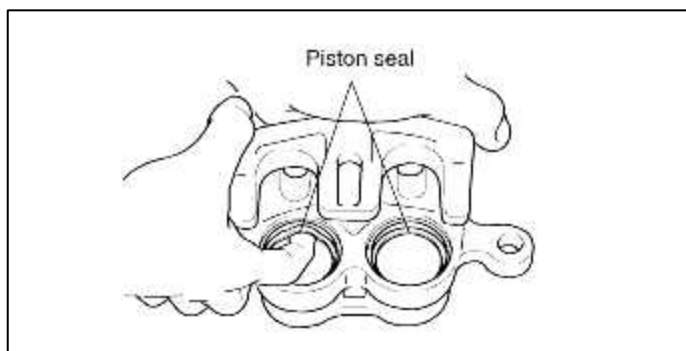
Do not use a screwdriver or another tool because it may damage the cylinder.

(2) Clean the piston surface and inner cylinder using alcohol or the specified brake fluid.

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Brake fluid : DOT 3 or DOT 4

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**INSPECTION****FRONT BRAKE THICKNESS CHECK**

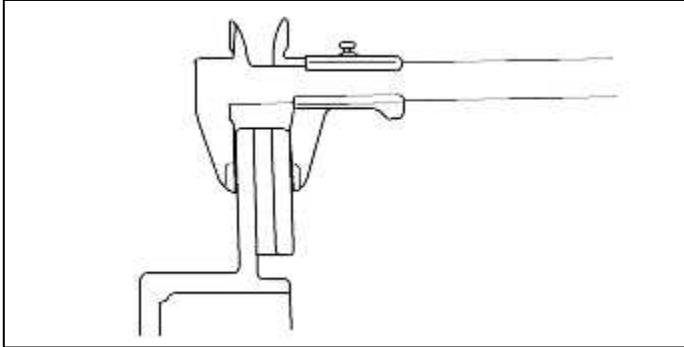
1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 4 positions at least.

Front brake disc thickness

Standard value : 28mm (1.10 in.)

Limit : 26mm (1.02 in.)

2. Thickness variation should not exceed 0.005mm (circumference) and 0.05mm (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly for left and right of the vehicle.

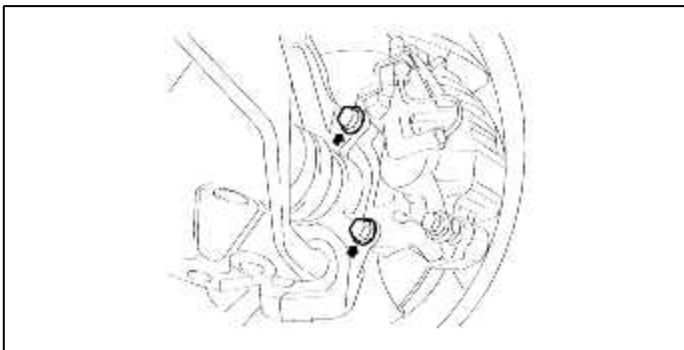


#### FRONT BRAKE DISC RUNOUT CHECK

1. Remove the caliper support, then raise the caliper assembly upward and suspend with a wire.

Tightening torque :

65-75 N·m (6.5-7.5 kg·m, 47-54 lb·ft)



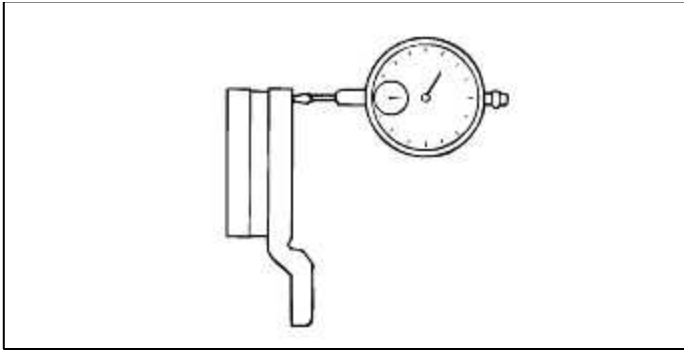
2. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout

Limit : 0.03mm (0.0012 in.) or less

#### NOTE

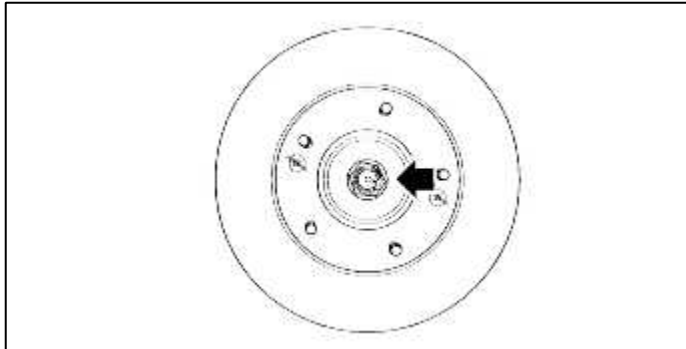
Fix the disc to the hub by tightening the nut.



### FRONT BRAKE DISC RUN OUT CORRECTION

1. If the runout of the brake disc is equivalent to or exceeds the limit specification, replace the disc and hub, and then measure the runout again.

(1) Before removing the brake disc, chalk both sides of the screw on the side at which the runout is greatest.



(2) If it exceeds the limit, disassemble the hub knuckle and check each part.

(3) If the runout does not exceed the limit specification, install the brake disc after turning it 180° from the chalk mark, and then check the runout of the brake disc again.

2. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

### INSPECTION

1. Check the cylinder for wear, damage and rust.
2. Check the piston surface for wear, damage and rust.
3. Check the caliper body and sleeve for wear.
4. Check that grease is applied, and the pad and backing metal are not damaged.
5. Check the pad wear. Measure the pad thickness and replace it if it is less than the specified value.

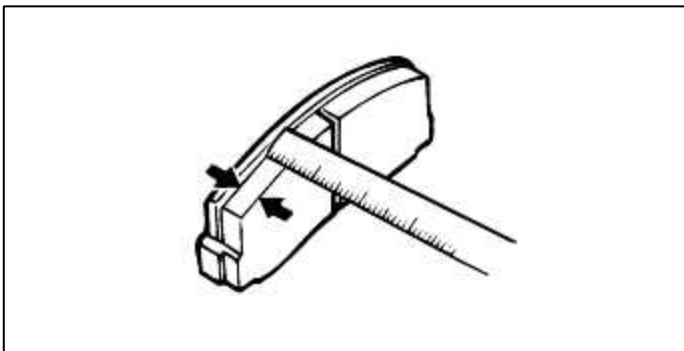
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#### Pad thickness

Specification : 10.5 mm (0.413 in.)

Service limit : 2.5 mm (0.098 in.)

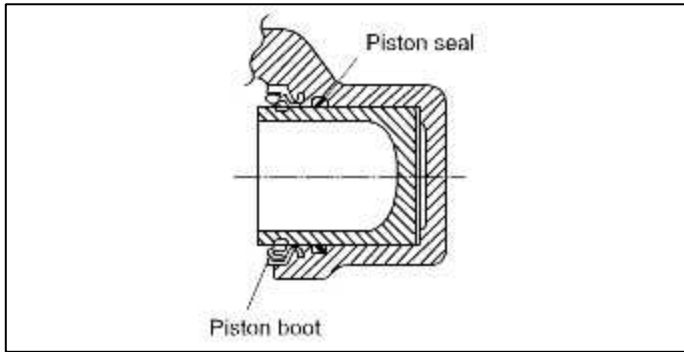
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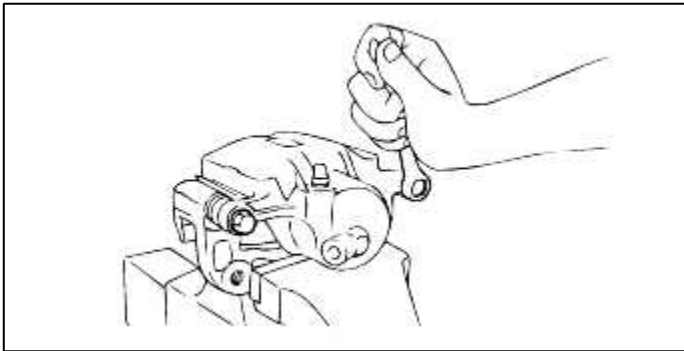
### REASSEMBLY

1. Clean all components with isopropyl alcohol except for the pad and shim.

2. Install the piston seal.
3. After applying the specified brake fluid to the piston outer surface, install the piston into the cylinder.
4. Install the piston boot.



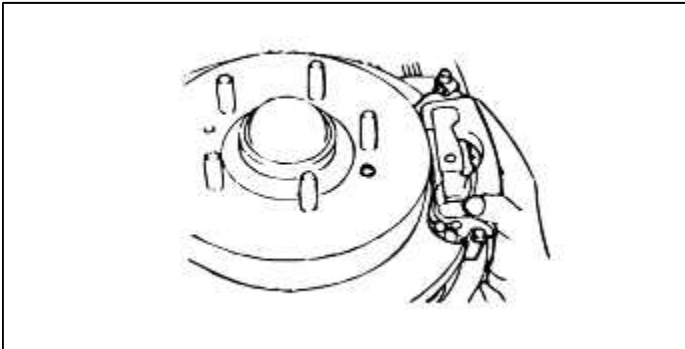
5. Install the guide pin boots and guide pin.



#### Brake System > Brake System > Rear Disc Brake > Repair procedures

##### REMOVAL

1. Remove the wheel.
2. Remove the guide bolt, lift up the caliper assembly, and remove the pad assembly.



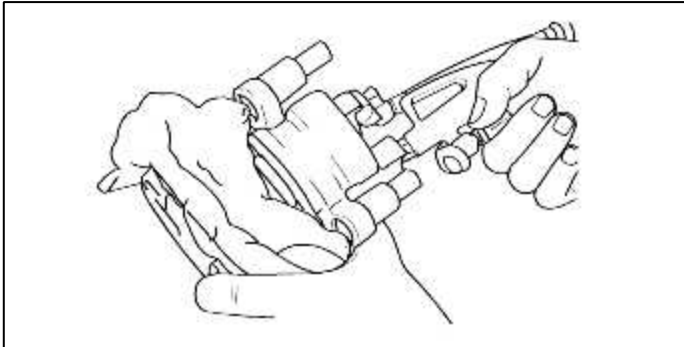
##### DISASSEMBLY SERVICE POINT

### 1. Remove the piston boot/piston.

Wrap the caliper body with a rag. Blow compressed air into the brake hose, and remove the piston and the piston boot.

#### CAUTION

Blow air slowly.



### 2. Remove the piston seal.

(1) Remove the piston seal with your finger.

#### CAUTION

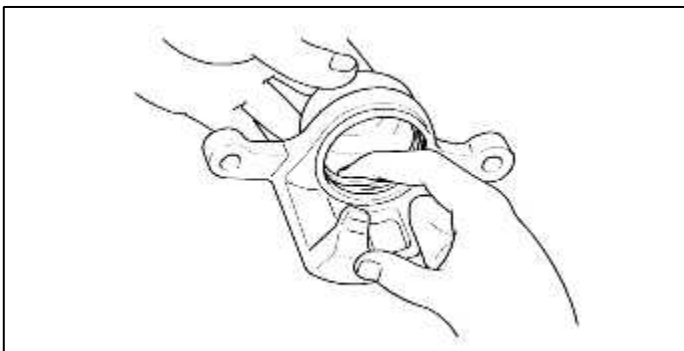
Do not use a screwdriver or another tool in order to avoid damage the inside of the cylinder.

(2) Clean the piston surface and the inside of the cylinder using trichloro-ethylene, alcohol or the specified brake fluid.

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Brake fluid : DOT 3 or DOT 4

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### REMOVAL (CALIPER)

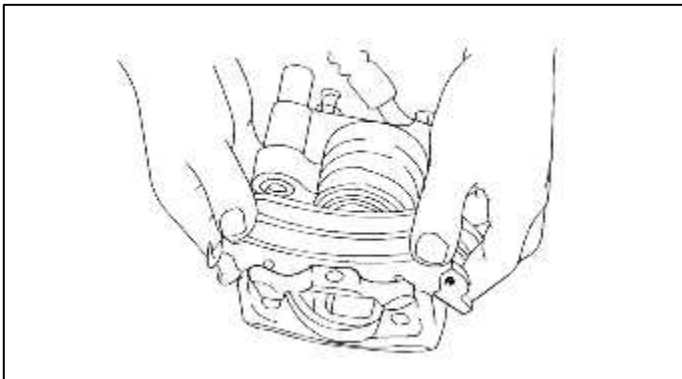
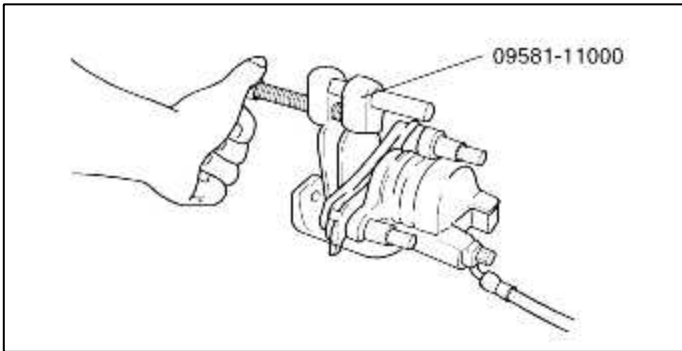
1. Remove the rear wheel.
2. Remove the caliper assembly.
3. Remove the brake hose from the caliper.

### INSTALLATION

1. Before replacing the brake pads, drain brake fluid from the master cylinder reservoir until it remains half full.



2. Remove the brake pad by turning the piston in the housing assembly. Using the special tool (09581-11000), remove the piston.



3. Install two caliper guide rods and tighten to a torque of 22-32 Nm (220-320 kg·cm, 16-23 lb·ft)
4. After filling the master cylinder reservoir with the fluid, bleed the brake line.

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Recommended brake fluid : DOT 3 or DOT 4

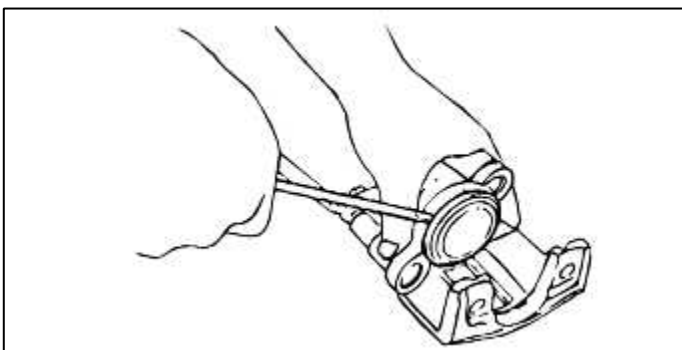
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## DISASSEMBLY (CALIPER)

1. Remove the pad.
2. Remove the piston boot from the housing, and then remove the piston.

### NOTE

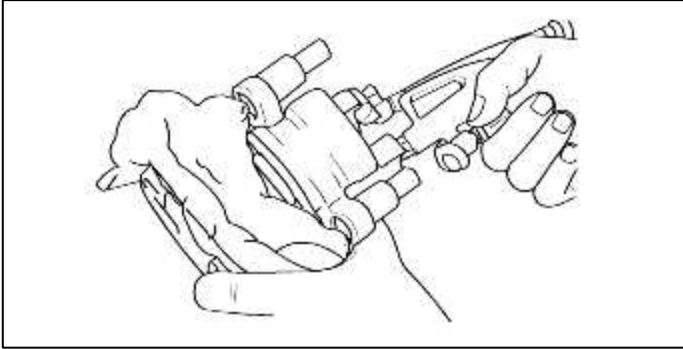
Using a wire hanger or equivalent, remove the caliper so as not to damage the brake hose.



3. Remove the piston by applying compressed air through the brake hose fitting.

**NOTE**

Do not place your fingers in front of the piston when using compressed air.

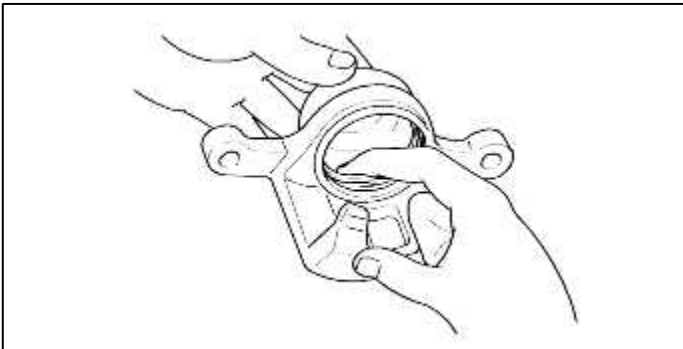


4. Remove the piston seal carefully so as not to damage the cylinder wall.  
5. Clean all removed parts with the specified fluid.

Item	Specified fluid
Metal section	Trichloroethylene, alcohol or brake fluid
Piston seal	If the oil level is low, add fluid (about 70cc).
Piston boot and other rubber parts	Alcohol

**CAUTION**

Rubber parts should be replaced with new ones but if you want to reuse them, don't put them in alcohol for more than thirty minutes.

**INSPECTION**

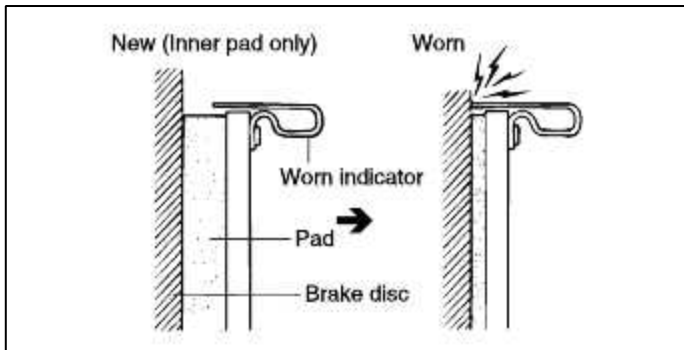
1. Check the cylinder for wear, damage and rust.
2. Check the piston surface for wear, damage and rust.
3. Check the caliper body and sleeve for wear.
4. Check that grease is adhesive, and the pad and backing metal are damaged.

5. Check the pads for wear or oil contamination and replace if necessary.

**NOTE**

The pads for the right and left wheels should be replaced at the same time.

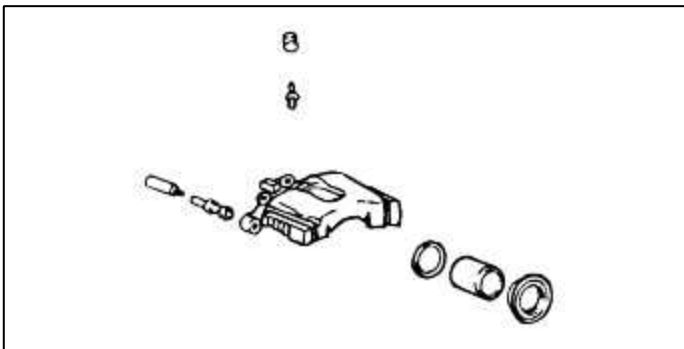
Pad thickness wear limit : 2.0mm (0.08 in.)



6. Check for worn or damaged dust boots. If dust or mud had entered the caliper assembly through the seal, the caliper assembly must be replaced or repaired.

#### INSPECTION (CALIPER)

1. Check the piston and its inside for wear, damage and rust.  
Replace the damaged parts if necessary.
2. Check the piston seal, boot, and pin insulators for wear and damage.



#### INSTALLATION (CALIPER)

1. Install the caliper mounting bolts.

Tightening torque :

65-75 N·m (6.5-7.5 kg-m, 47-54 lb-ft)

2. Refer to "Brake pad installation" for detail.
3. Install the brake hose connector

Tightening torque :

17-20 N·m (1.7-2.0 kg-m, 12-14 lb-ft)

4. Install the caliper guide bolt.

Tightening torque :

22-32 N·m (2.2-3.2 kg-m, 16-23 lb-ft)

## 5. Bleed the system.

**CAUTION**

When replacing the piston seal, check the pedal stroke. If the pedal stroke is too excessive, the piston may not retain the piston seal.

Adjust as follows :

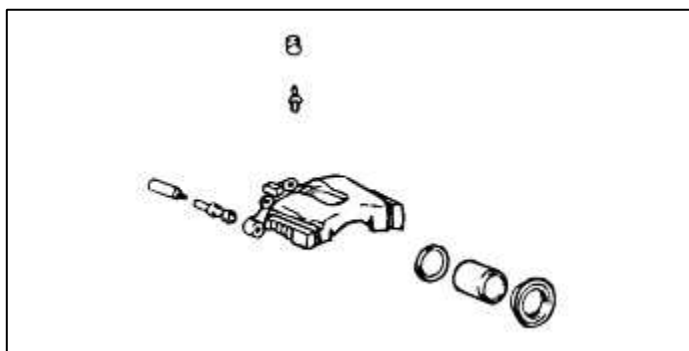
1. After removing the pad from the piston, push the piston into the cylinder 3-5mm. Put a lever or steel plate (1mm x 0.3m) between the piston and disc, being careful not to damage the contact surface of the disc or the piston end.
2. Install the pad. To restore the brake pedal to the original position, step on it 2-3 times.
3. Repeat the above procedure more than 5 times and move the piston outward and inward to assure that the piston seal is properly installed.
4. Before driving a vehicle, step on the brake pedal and release it several times.
5. Perform the road test.

**REASSEMBLY (CALIPER)**

1. When disassembling the caliper assembly, use a new piston seal and boot.
2. Apply the recommended fluid to the bearing part of the piston seal and piston. Insert the piston seal into grooves inside the caliper, being careful not to twist the seal.

Item	Recommended fluid	Quantity
Piston seal	Brake fluid (DOT3, DOT4)	As required
Inside of piston cylinder	Brake fluid (DOT3, DOT4)	As required
Piston boot	Brake fluid (DOT3, DOT4)	As required
Locating pin insulator	White silicone grease	As required

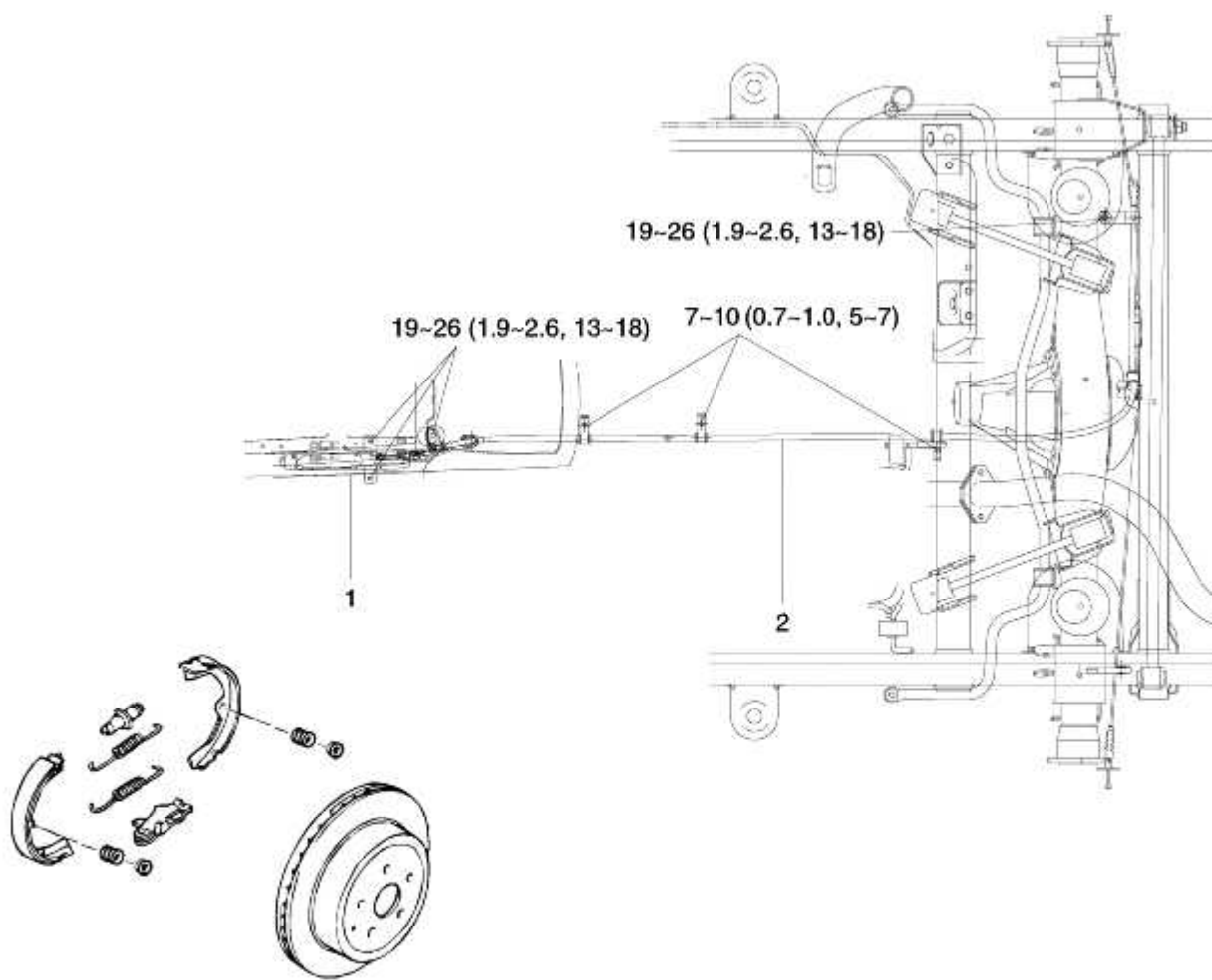
3. Install the piston boot to the piston. Confirm that the concave part of the piston is placed outward and the boot is seated in grooves of the piston completely.



4. Install the piston and boot in the caliper housing. Insert the boot flange in the caliper housing and check that the boot fits in grooves around the piston.
5. Apply the recommended oil to the inside of the locating pin insulator.

**Brake System > Parking Brake System > Parking Brake Assembly > Components and Components Location**

**COMPONENT**



**TORQUE : N·m (kg·m, lb·ft)**

1. Parking brake lever
2. Parking brake cable

### Brake System > Parking Brake System > Parking Brake Assembly > Repair procedures

#### REMOVAL (LEVER)

1. Remove the console
2. Loosen the lever adjusting nut
3. Detach the cable from the lever
4. Remove the lever mounting bolts and nuts
5. Disconnect the parking brake switch connector

#### REMOVAL (CABLE)

1. Remove the console
2. Loosen the lever adjusting nut
3. Detach the cable from the lever
4. Remove the cable clip which connect the cable to the body and install the axle housing
5. Remove the parking cable from the operating lever

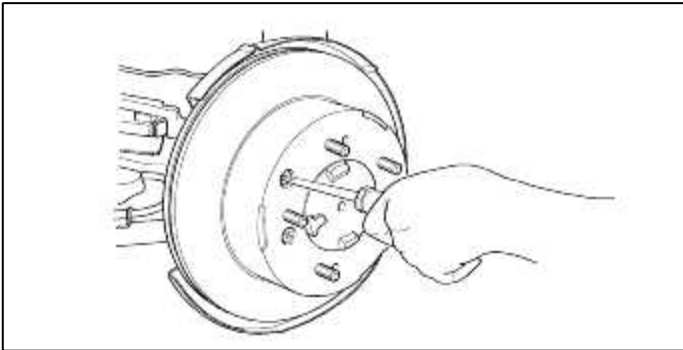
#### REMOVAL (BRAKE SHOE)

1. Remove rear disk caliper assembly.(Refer to "Rear disk brake")

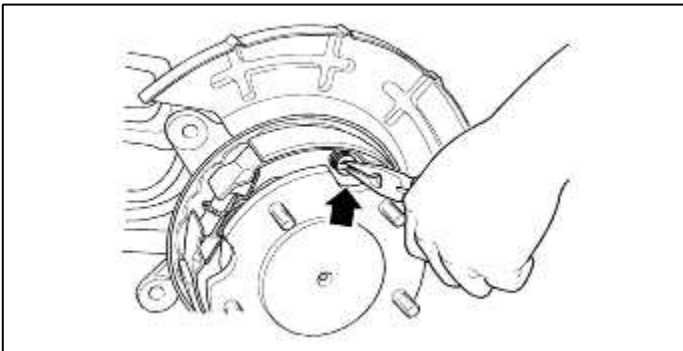
2. Before removing the brake disk, chalk both sides of the screw.

**NOTE**

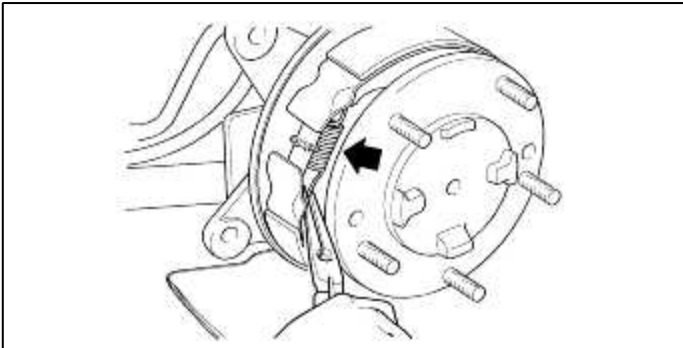
Reduce the shoe gap by turning the adjuster with appropriate tool.



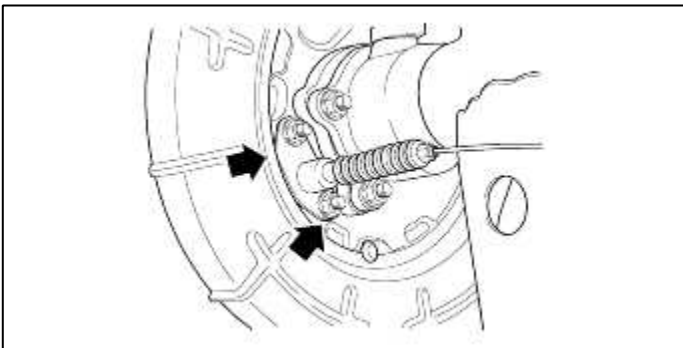
3. After turning the pin to coincide with hole of spring cap, remove the shoe hold spring.



4. Remove the lower return spring.



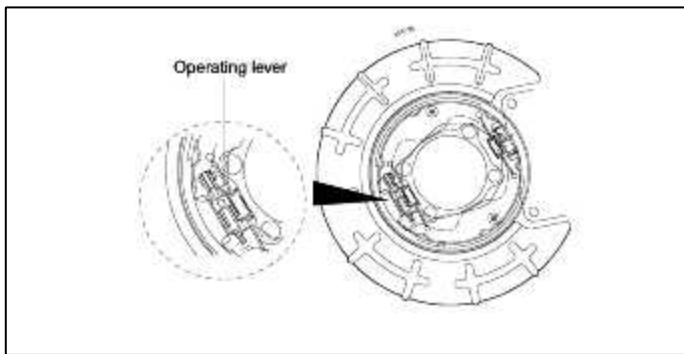
5. Remove the parking brake cable mounting nuts.



6. Remove the parking brake shoes.

**ASSEMBLY (BRAKE SHOE)**

1. Install the parking brake cable to the operating lever and then install the operating lever as shown in the figure.

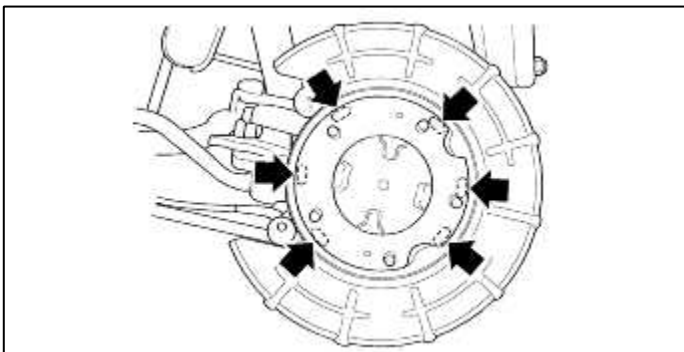


2. Tighten the parking brake cable mounting nuts.

Tightening torque

47-54 N·m (4.7-5.4 kg·m, 34-39 lb·ft)

3. Apply the grease to the area in the figure.



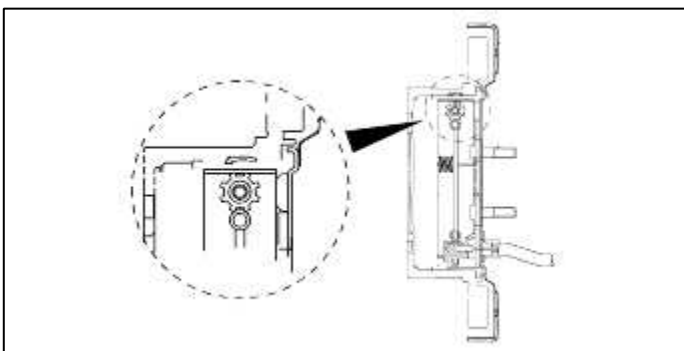
4. Install the upper return spring and brake shoes
5. Turn the adjuster in clockwise direction and install.

#### NOTE

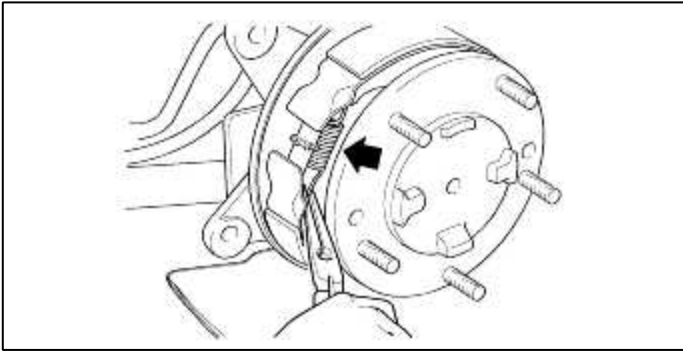
Direction of adjuster turn

Clockwise : narrowing the shoe gap.

Counterclockwise : widen the shoe gap.



6. Install the lower return spring.



7. Install the shoe hold spring with a plier.  
8. Install the disk brake and then align the mark while tightening the screw.

## INSPECTION

1. Measure the drum inside diameter.

---

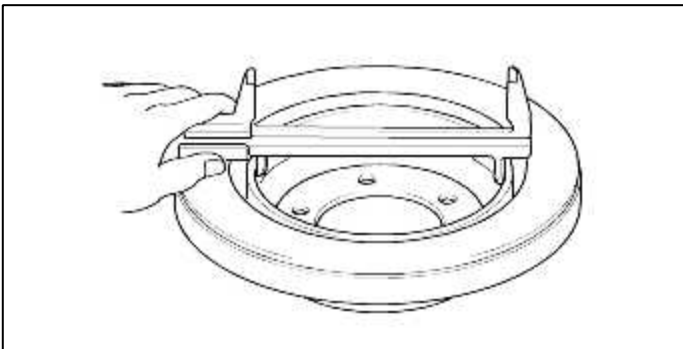
Standard value : 190mm (7.48 in.)

Service limit : 191mm (7.52 in.)

---

### CAUTION

If the brake drum inner diameter is greater than the service limit, replace the brake drum.



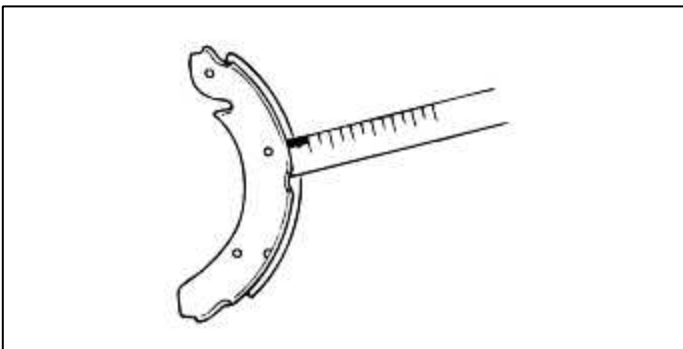
2. Measure the brake lining thickness.

---

Standard value : 4mm (0.157 in.)

Service limit : 1.5mm (0.059 in.)

---

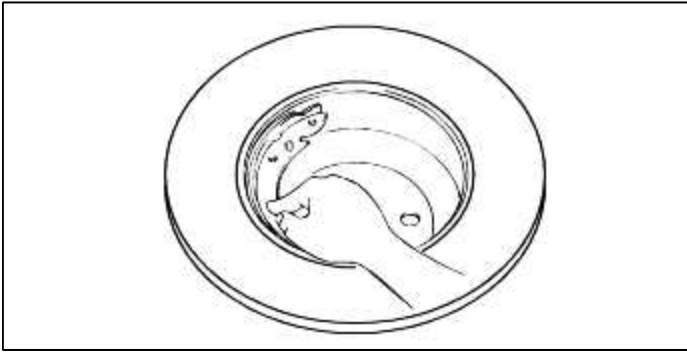


### CAUTION

If the brake lining thickness is less than the service limit, replace the brake lining.

3. Inspect the brake lining and drum for proper contact. 048@gmail.com





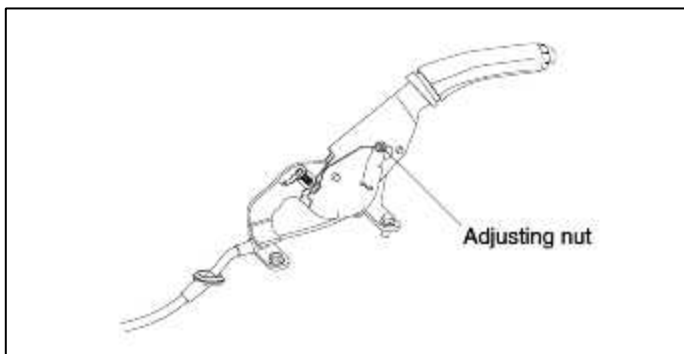
## ADJUSTMENT PROCEDURE

### Parking brake stroke adjustment

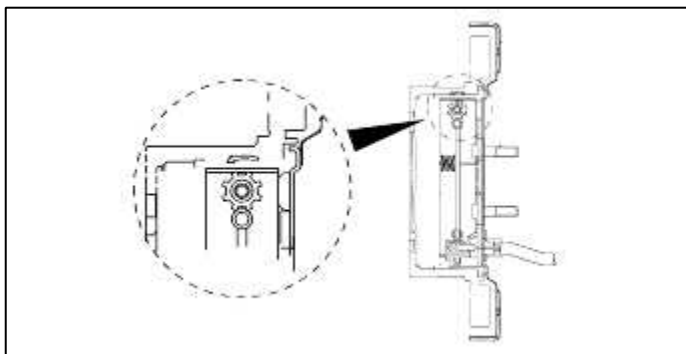
1. Pull the brake lever with force of 100N (10kg, 22lbs) and count the number of notches.

### Parking brake stroke

Standard value : 4 ~ 6 clicks



2. If the parking brake stroke is out of the standard value, adjust it as follows :
  - (1) Loosen the adjusting nut to release the parking brake cable.
  - (2) Remove the adjusting hole plug, and then turn the adjuster in the direction of the arrow. To prevent the disc from rotating, use a screwdriver (flat tip(-)).



- (3) Turn the adjuster 5 notches in the opposite direction of arrow.
- (4) Turn the adjuster nut to adjust the parking brake stroke to the specification.

### CAUTION

If the number of parking brake notches is less than the specification, loosen the adjusting nut and readjust.

- (5) After adjusting the parking brake stroke, raise the rear of vehicle with a jack.
- (6) Check that the rear brakes do not drag by turning the rear wheel when the parking brake lever is released.

## PARKING BRAKE BED-IN (DIH)

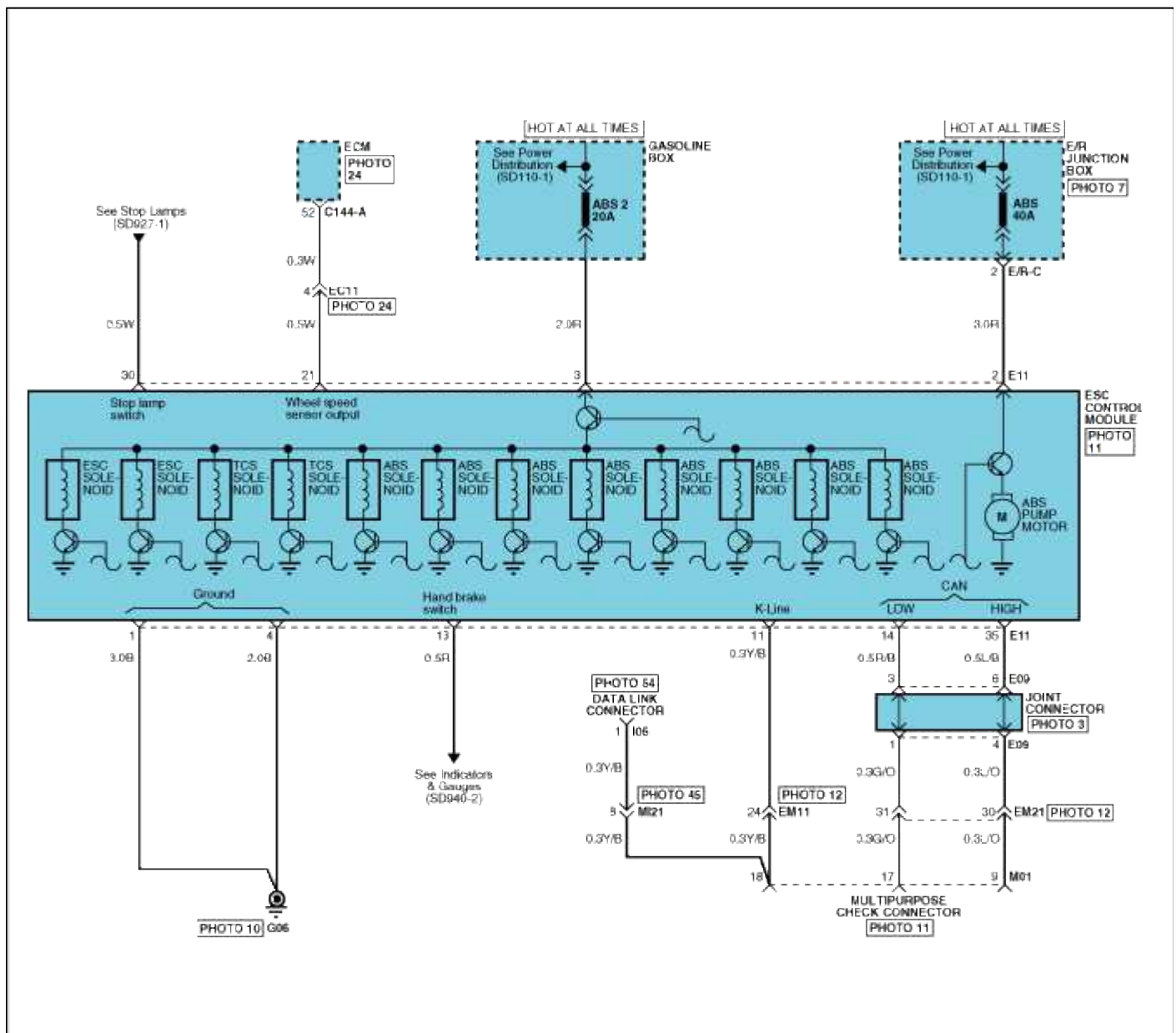
1. When the parking brake lever is pulled with force of 15 kg(f), drive the vehicle 500m at 60 kph, or accelerate to 60 kph on a roll device.
2. Repeat step 1 more than 2 times.
3. Parking should be possible on a hill of 30% with gross vehicle weight.

NOTE

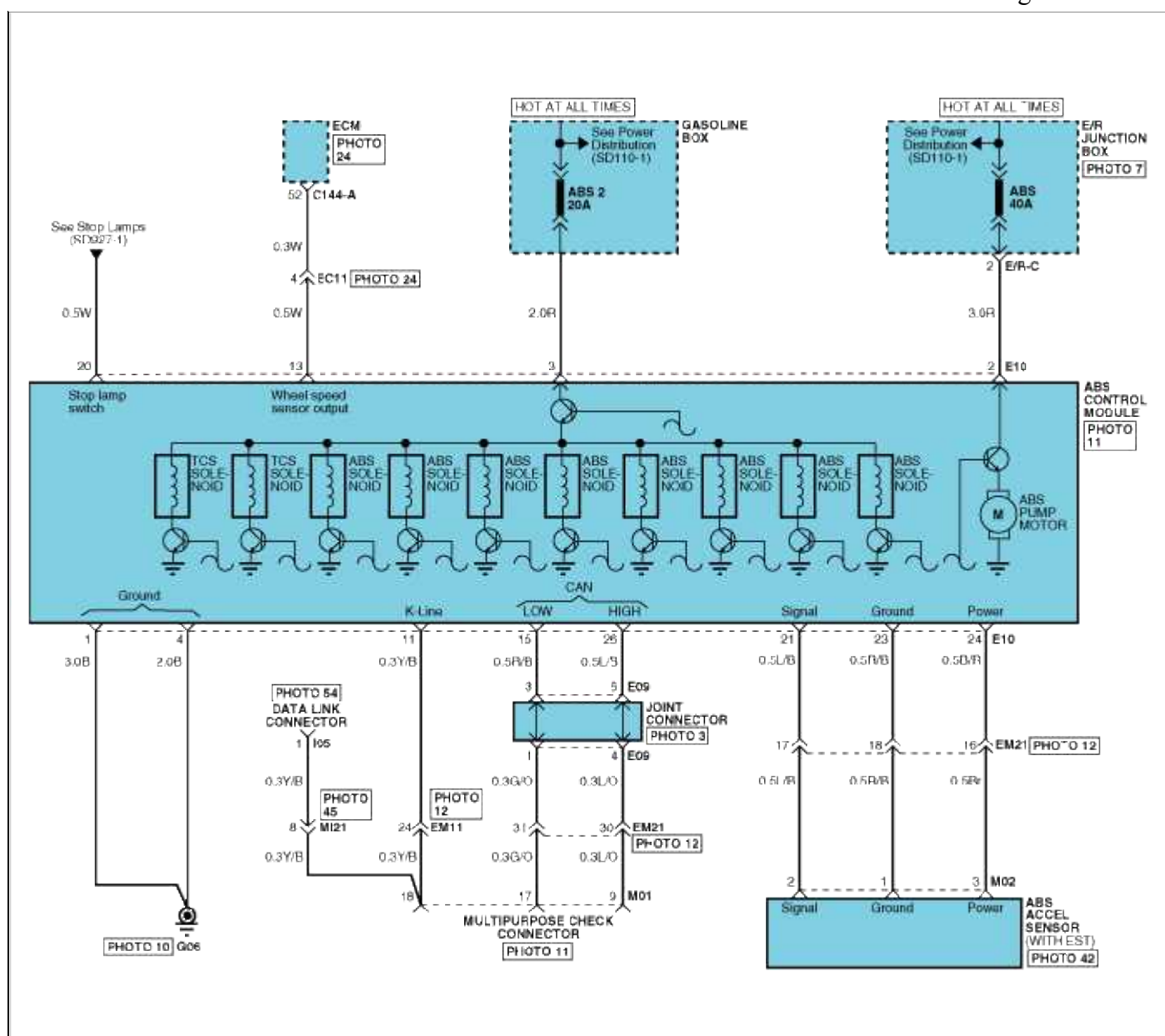
- BED-IN : Procedure of operating the vehicle with parking brakes active for the purpose of setting the position of the brake pads.
- DIH (Drum in hat) : Disk brake type parking system.

## Brake System > ABS(Anti-Lock Brake System) > Schematic Diagrams

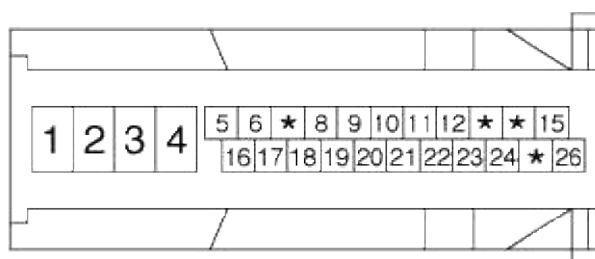
### ABS CIRCUIT DIAGRAM(1)



### ABS CIRCUIT DIAGRAM(2)



### ECU CONNECTOR INPUT/OUTPUT(ABS)



Wire No.	Designation	Current		max.permissible wire resistance R_L (mΩ)	min.leakage resistance R_P (kΩ)
		max	min		
1	Ground for recirculation pump	20~39 A	10 A	10	
4	Ground for solenoid valves and ECU	5~15 A	2.5 A	10	
2	Voltage supply for pump motor	20~39 A	10 A	10	200
3	Voltage supply for solenoid valves	5~15 A	2 A	10	200
18	Voltage for hybrid ECU	1 A	500 mA	60	200
5,10,17,19	signal wheel speed sensor FL, FR, RL,RR	16 mA	6 mA	250	200 to ground 1.5M to bat
16,9,6,8	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	10 mA	6 mA	250	200 to ground 1.5M to bat
11	Diagnostic wire K	6 mA	3 mA	250	200
22	ABS-warning lamp actuation	30 mA	5 mA	250	200
12	EBD-warning lamp actuation	30 mA	5 mA	250	200
20	brake light switch	10 mA	5 mA	250	200
15	CAN Low	30 mA	20 mA	250	200
26	CAN High	30 mA	20 mA	250	200

### ABS HECU CONNECTOR

Connector terminal		Specification	Condition
Number	Description		
1	Ground for recirculation pump	Current range: Min.10A Max.20~39A	Always
4	Ground for solenoid valves and ECU	Current range: Min.2.5A Max.5~15A	Always
2	Voltage supply for pump motor	Battery voltage	Always
3	Voltage supply for solenoid valves		
16	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG ON
9			
6			
8			
5	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.89~1.26 V Voltage (Low) : 0.44~0.63 V	On driving
10			
17			
19			

11	Diagnostic wire K	Voltage (High) $\geq 0.8 * IG\ ON$ Voltage (Low) $\leq 0.2 * IG\ ON$	On SCAN TOOL communication
18	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
20	Brake light switch	Voltage (High) $\geq 4.5 * IG\ ON$ Voltage (Low) $\leq 2.0 * IG\ ON$	BRAKE ON/OFF

**SENSOR OUTPUT ON SCAN TOOL(ABS)**

	Description	Abbreviation	Unit	Remarks
1	Vehicle speed sensor	VEH. SPD	Km/h	
2	Battery voltage	BATT. VOL	V	
3	FL Wheel speed sensor	FL WHEEL	Km/h	
4	FR Wheel speed sensor	FR WHEEL	Km/h	
5	RL Wheel speed sensor	RL WHEEL	Km/h	
6	RR Wheel speed sensor	RR WHEEL	Km/h	
7	ABS Warning lamp	ABS LAMP	-	
8	EBD Warning lamp	EBD LAMP	-	
9	Brake Lamp	B/LAMP	-	
10	Pump relay state	PUMP RLY	-	
11	Valve relay state	VALVE RLY	-	
12	Motor	MOTOR	-	
13	Front Left valve(IN)	FL INLET	-	
14	Front Right valve (IN)	FR INLET	-	
15	Rear Left valve (IN)	RL INLET	-	
16	Rear Right valve (IN)	RR INLET	-	
17	Front Left valve (OUT)	FL OUTLET	-	
18	Front Right valve (OUT)	FR OUTLET	-	
19	Rear Left valve(OUT)	RL OUTLET	-	
20	Rear Right valve (OUT)	RR OUTLET	-	

**Brake System > ABS(Anti-Lock Brake System) > Description and Operation****DESCRIPTION**

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)

This specification is for the wiring design and installation of ABS/TCS/ESC ECU.

This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.

- Control of braking force / traction force/ yaw moment.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

### Installation position : engine compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

### OPERATION

The ECU shall be put into operation by switching on the operating voltage (IGN).

On completion of the initialization phase, the ECU shall be ready for operation.

In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

### Wheel Sensor signal processing

The ECU shall receive wheel speed signal from the four active wheel sensors.

The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the MCU.

### Solenoid Valve Control

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.

The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

### Voltage limits

#### - Overvoltage

When overvoltage is detected (above 16.8 V), the ECU switches off the valve relay and shuts down the system.

When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.

#### - Undervoltage

In the event of undervoltage (below 9.3 V), ABS control shall be inhibited and the warning lamp shall be turned on.

When voltage is returned to operating range, the warning lamp is switched off and ECU returns to normal operating mode.

### Pump Motor Checking

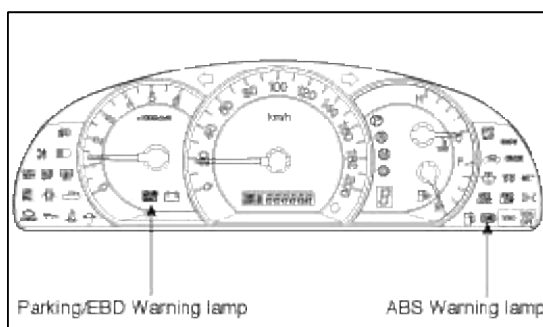
The ECU performs a pump motor test at a speed of 30km/h (18.6mph) once after IGN is switched on.

### Diagnostic Interface

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.

The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU (Air-bleeding line or Roll and Brake Test line).

### Warning Lamp module



## 1. ABS WARNING LAMP MODULE

The active ABS warning lamp module indicates the selftest and failure status of the ABS. The ABS warning lamp shall be on:

- A. During the initialization phase after IGN ON. (continuously 3 seconds).
- B. In the event of inhibition of ABS functions by failure.
- C. During diagnostic mode.
- D. When the ECU Connector is separated from ECU.

## 2. PARKING/EBD WARNING LAMP MODULE

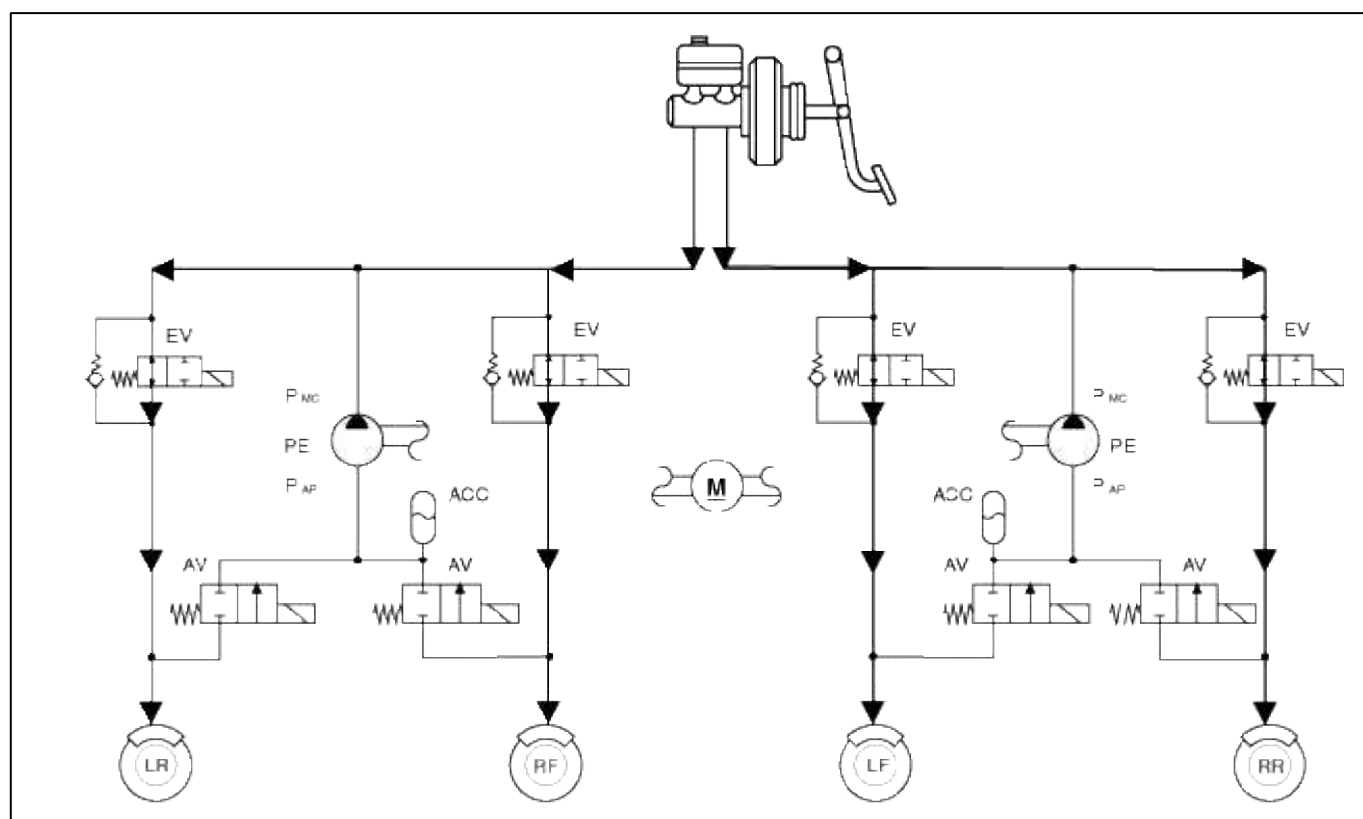
The active EBD warning lamp module indicates the selftest and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- A. During the initialization phase after IGN ON. (continuously 3 seconds).
- B. When the Parking Brake Switch is ON or brake fluid level is low.
- C. When the EBD function is out of order.
- D. During diagnostic mode.
- E. When the ECU Connector is separated from ECU.

## ABS CONTROL

### 1. NORMAL BRAKING without ABS

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF

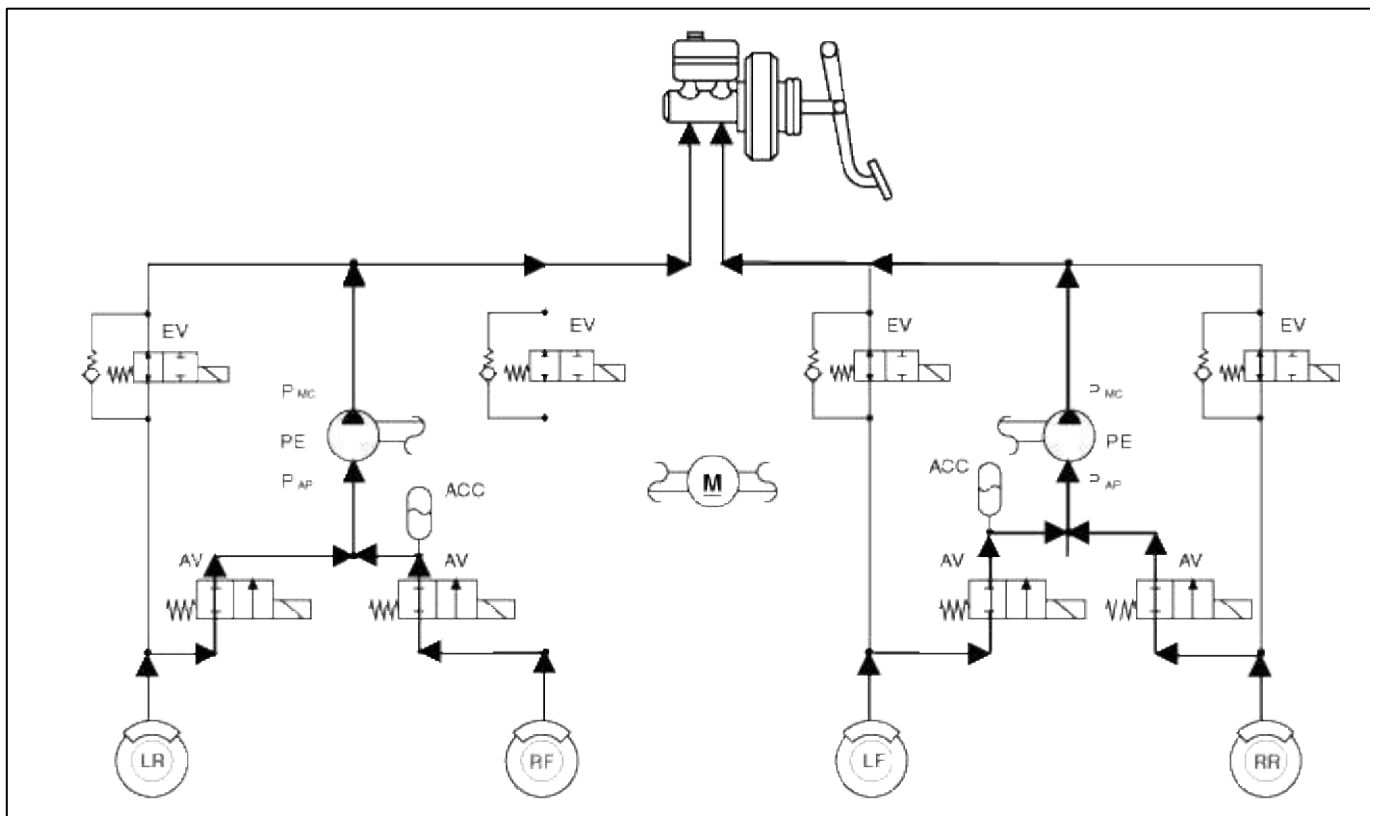


**NOTE**

EV : Inlet Valve  
 AV : Outlet Valve  
 LR : Rear left wheel  
 RF : Front right wheel  
 LF : Front left wheel  
 RR : Rear right wheel  
 PE : Pump motor

**2. DECREASE MODE**

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Open	ON(Motor speed control)

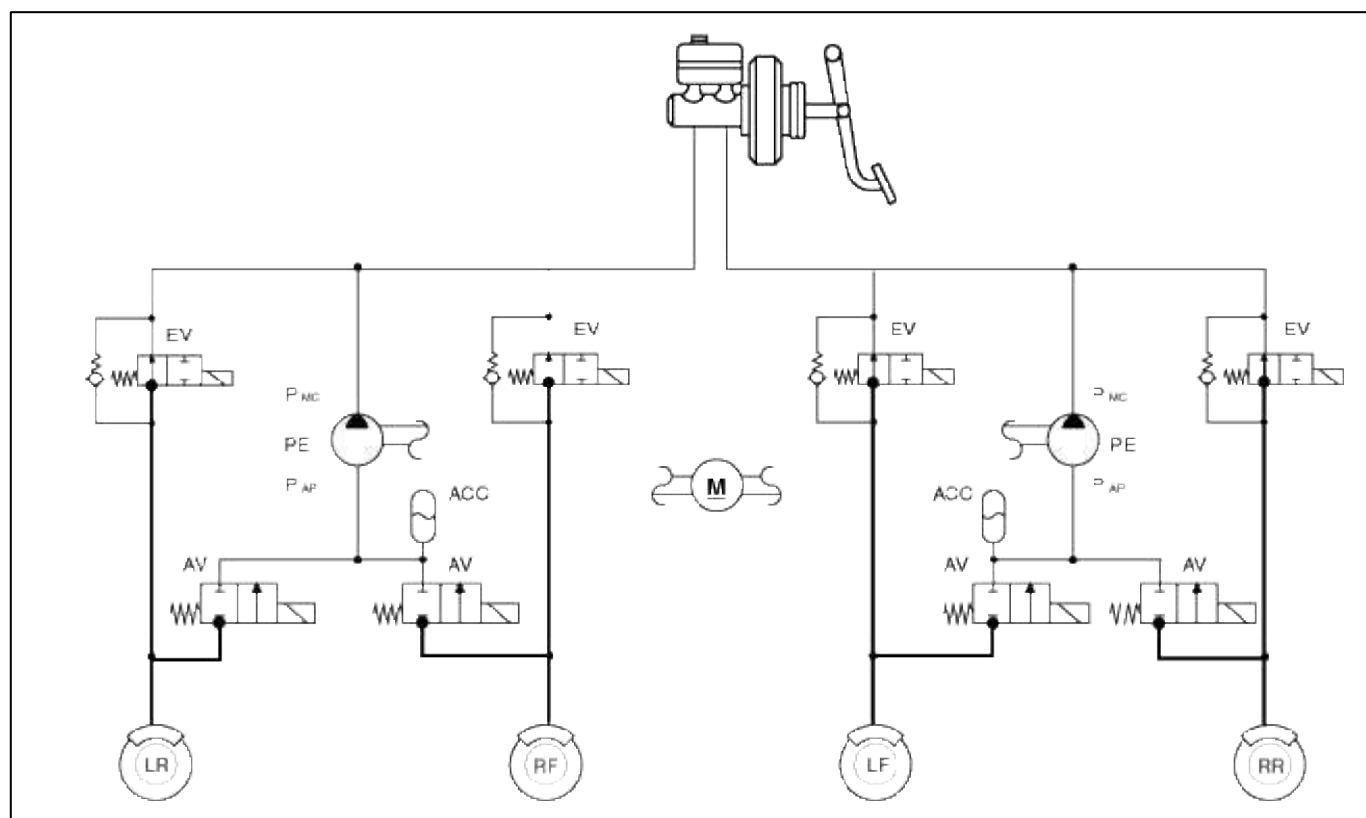
**NOTE**

EV : Inlet Valve  
 AV : Outlet Valve  
 LR : Rear left wheel  
 RF : Front right wheel  
 LF : Front left wheel  
 RR : Rear right wheel  
 PE : Pump motor



## 3. HOLD MODE

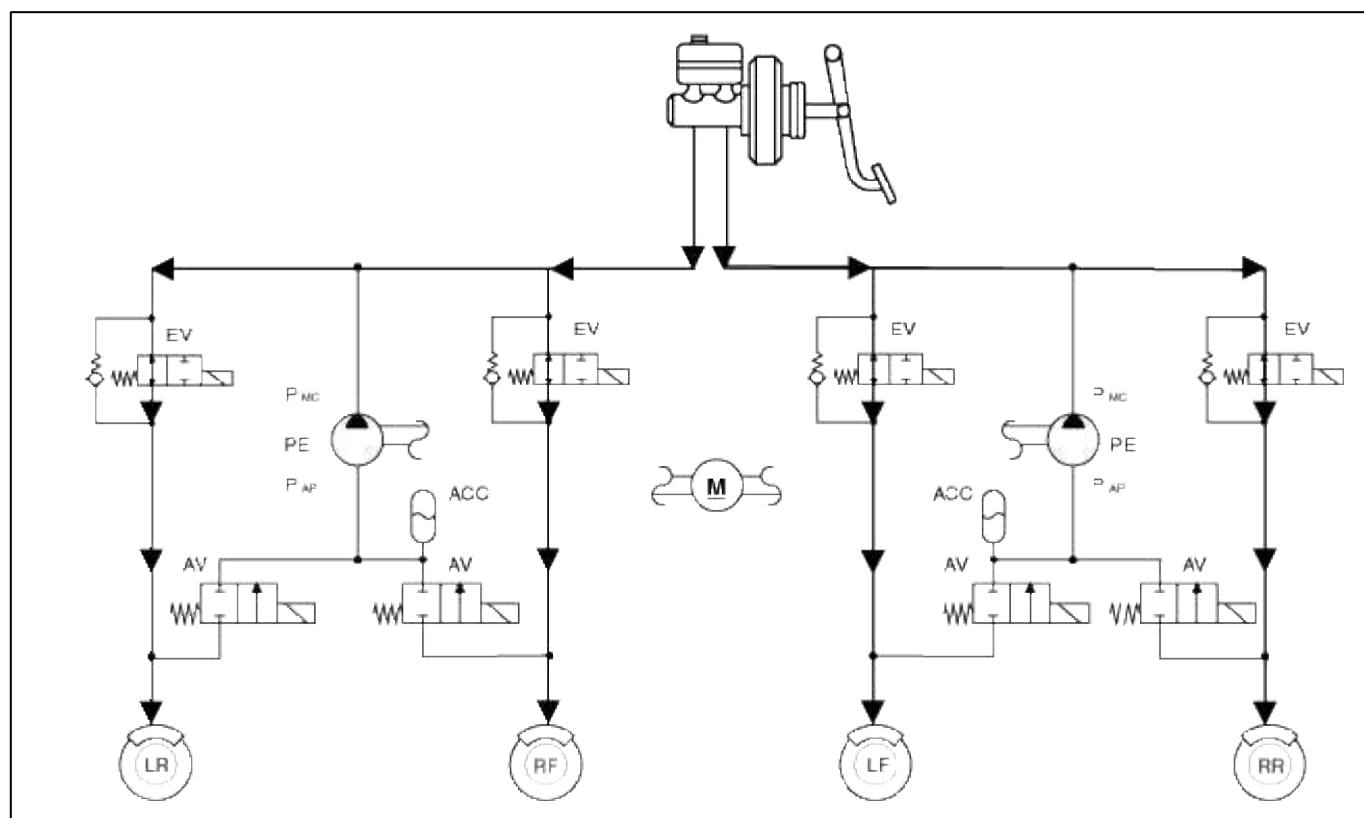
	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Close	ON(Motor speed control

**NOTE**

EV : Inlet Valve  
 AV : Outlet Valve  
 LR : Rear left wheel  
 RF : Front right wheel  
 LF : Front left wheel  
 RR : Rear right wheel  
 PE : Pump motor

## 4. INCREASE MODE

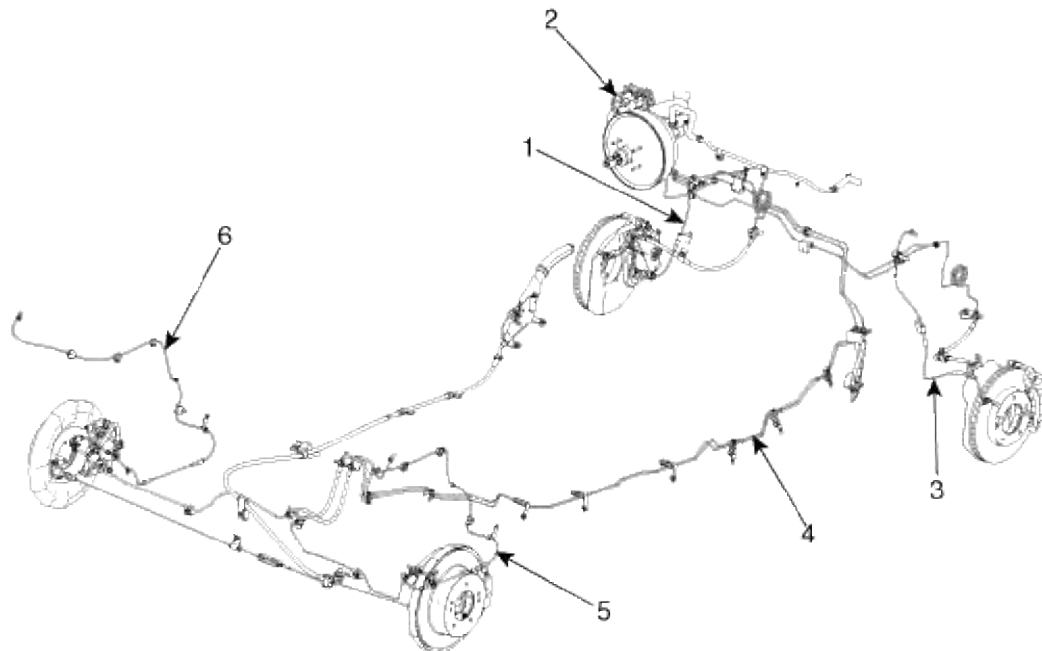
	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	ON(Motor speed control)

**NOTE**

EV : Inlet Valve  
 AV : Outlet Valve  
 LR : Rear left wheel  
 RF : Front right wheel  
 LF : Front left wheel  
 RR : Rear right wheel  
 PE : Pump motor

**Brake System > ABS(Anti-Lock Brake System) > Components and Components Location**

## COMPONENTS

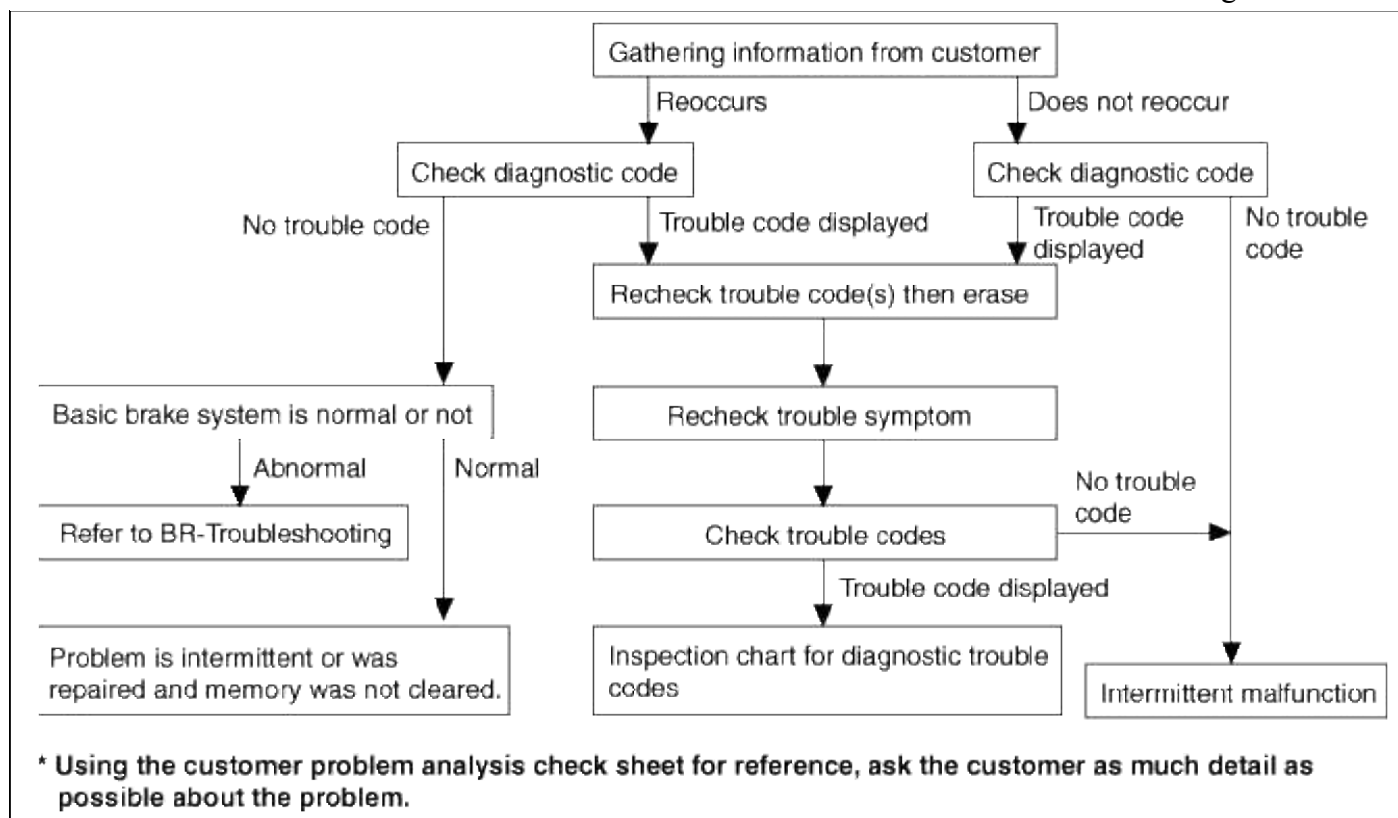


1. Front left wheel speed sensor
2. ABS control module(HECU)
3. Front right wheel speed sensor

4. Hydraulic line
5. Rear right wheel speed sensor
6. Rear left wheel speed sensor

### Brake System > ABS(Anti-Lock Brake System) > Troubleshooting

#### STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



## NOTES WITH REGARD TO DIAGNOSIS

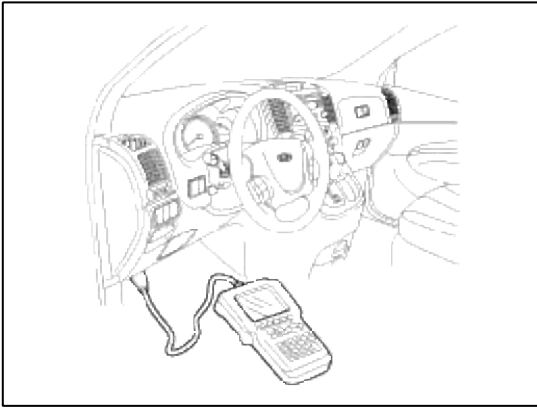
The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

## SCAN TOOL CHECK

1. Turn the ignition switch OFF.

2. Connector the Scan tool to the 16P data link connector located the driver's side kick panel.



3. Turn the ignition switch ON.
4. Check for DTC using the Scan tool
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes using the scan tool.
6. Disconnect the Scan tool from the 16P data link connector.

ABS CHECK SHEET

## ABS Check Sheet

 Inspector's  
Name \_\_\_\_\_

<b>Customer's Name</b>		<b>Registration No.</b>	
		<b>Registration Year</b>	/      /
		<b>VIN.</b>	
<b>Date Vehicle Brought In</b>	/      /	<b>Odometer</b>	Km Miles

<b>Date the Problem First Occurred</b>	/      /
<b>Frequency of Occurrence of Problem</b>	<input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent (      times a day)

<b>Symptoms</b>	<input type="checkbox"/> ABS does not operate.	
	<input type="checkbox"/> ABS does not operate efficiently.	<input type="checkbox"/> Intermittent (      times a day)
	<b>ABS Warning Light Abnormal</b>	<input type="checkbox"/> Remains ON <input type="checkbox"/> Does not light up

<b>Diagnostic Trouble Code Check</b>	<b>1st Time</b>	<input type="checkbox"/> Normal Code <input type="checkbox"/> Malfunction Code (Code      )
	<b>2nd Time</b>	<input type="checkbox"/> Normal Code <input type="checkbox"/> Malfunction Code (Code      )

### PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area
ABS does not operate.	Only when 1. -4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.
ABS does not operate intermittently.	Only when 1. -4. are all normal and the problem is still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the system is operating to specifications. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.
Communication with Scan tool is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line
Communication with Scan tool is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU

**CAUTION**

During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

**ABS Does Not Operate.****DETECTING CONDITION**

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	<ul style="list-style-type: none"> <li>- Inoperative power source circuit</li> <li>- Inoperative wheel speed sensor circuit</li> <li>- Inoperative hydraulic circuit for leakage</li> <li>- Inoperative HECU</li> </ul>

**INSPECTION PROCEDURES****DTC INSPECTION**

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.

2. Is the ABS MIL on?

**NO**

Check the power source circuit.

**YES**

Read DTC and troubleshoot said DTC.

CHECK THE POWER SOURCE CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

---

Specification: approximately B+

---

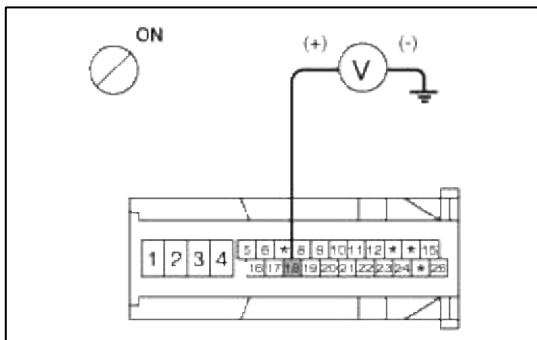
Is the voltage within specification?

**YES**

Check the ground circuit.

**NO**

Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



CHECK THE GROUND CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 1,4 of the ABS control module harness side connector and ground point.

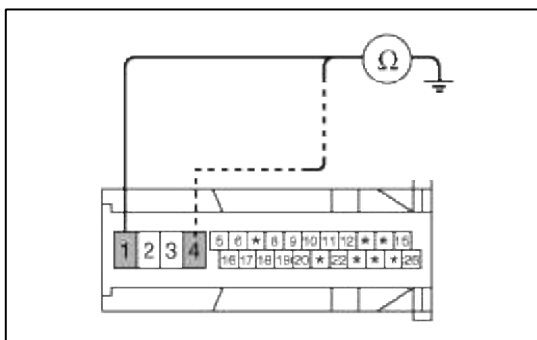
Is there continuity?

**YES**

No further action is required.

**NO**

Repair an open in the wire and ground point.



CHECK THE HYDRAULIC CIRCUIT.

Refer to the DTC troubleshooting procedures.

Is the system operating to specifications?

**YES**

Check for DTC troublecodes.



**NO**

Check the hydraulic circuit for leakage.

**CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.**

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.

Is the system operating to specifications?

**YES**

The problem is still occurring, replace the ABS control module.

**NO**

Replace the leaking hydraulic lines.

**ABS Does Not Operate (Intermittently).**

## DETECTING CONDITION

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	<ul style="list-style-type: none"> <li>- Inoperative power source circuit</li> <li>- Inoperative wheel speed sensor circuit</li> <li>- Inoperative hydraulic circuit for leakage</li> <li>- Inoperative HECU</li> </ul>

## INSPECTION PROCEDURES

### DTC INSPECTION

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Is the ABS MIL on?

**NO**

Check the wheel speed sensor circuit.

**YES**

Read DTC and troubleshoot said DTC.

**CHECK FOR DTC's.**

Refer to the DTC troubleshooting procedures.

Is the system operating to specifications?

**YES**

Check the stop lamp switch circuit.

**NO**

Repair or replace the wheel speed sensor.

**CHECK THE STOP LAMP SWITCH CIRCUIT.**

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.

2. Measure the voltage between terminal 20 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification: approximately B+

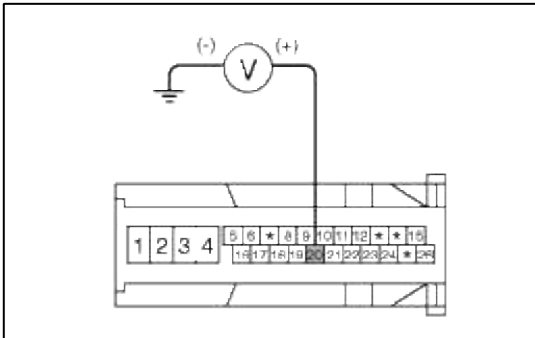
Is the voltage within specification?

**YES**

Check for DTC troublecodes.

**NO**

Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.



**CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.**

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.

Is the system operating to specifications?

**YES**

The problem is still occurring, replace the ABS control module.

**NO**

Replace the leaking hydraulic lines.

**Communication with Scan-Tool is not possible.  
(Communication with any system is not possible)**

## DETECTING CONDITION

Trouble Symptoms	Possible Cause
Possible malfunction in the power supply system (including ground) for the diagnosis line.	<ul style="list-style-type: none"> <li>- An open in the wire</li> <li>- Poor ground</li> <li>- Inoperative power source circuit</li> </ul>

## INSPECTION PROCEDURES

### CHECK THE POWER SUPPLY CIRCUIT FOR THE DIAGNOSIS

Measure the voltage between terminal 9 of the data link connector and body ground.

Specification: approximately B+

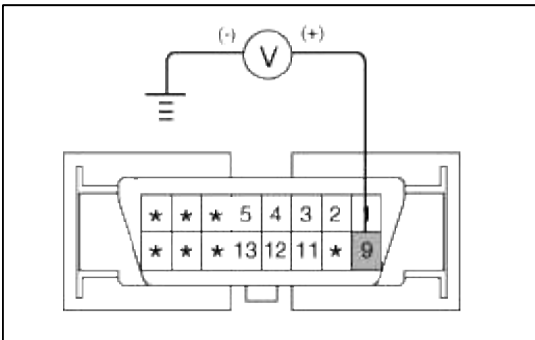
Is voltage within specification?

**YES**

Check the ground circuit for the diagnosis.

**NO**

Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.



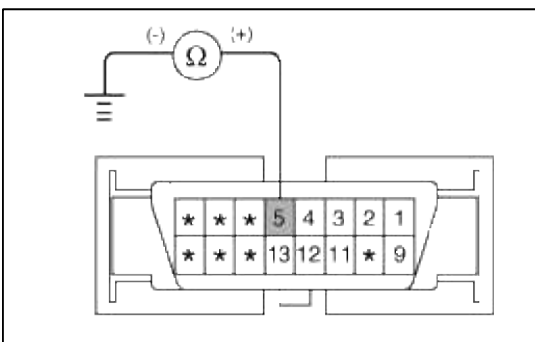
#### CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

Check for continuity between terminal 5 of the data link connector and body ground.

Is there continuity?

**NO**

Repair an open in the wire between terminal 5 of the data link connector and ground point.



**Communication with Scan Tool is not possible.  
(Communication with ABS only is not possible)**

#### DETECTING CONDITION

Trouble Symptoms	Possible Cause
When communication with Scan Tool is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	<ul style="list-style-type: none"> <li>- An open in the wire</li> <li>- Inoperative HECU</li> <li>- Inoperative power source circuit</li> </ul>

#### INSPECTION PROCEDURES

##### CHECK FOR CONTINUITY IN THE DIAGNOSIS LINE

1. Disconnect the connector from the ABS control module.

2. Check for continuity between terminals 11 of the ABS control module connector and 1 of the data link connector.

Is there continuity?

**YES**

Check the power source of ABS control module.

**NO**

Repair an open in the wire.

#### CHECK THE POWER SOURCE OF ABS CONTROL MODULE

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

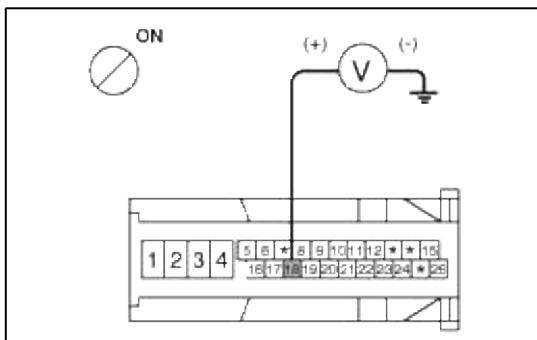
Is voltage within specification?

**YES**

Check for poor ground.

**NO**

Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



#### CHECK FOR POOR GROUND

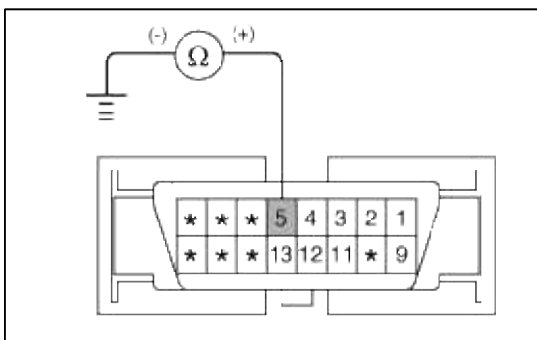
Check for continuity between terminal 5 of the data link connector and ground point.

**YES**

Replace the ABS control module and recheck.

**NO**

Repair an open in the wire or poor ground.



**When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.**

**DETECTING CONDITION**

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the inoperative HECU.	<ul style="list-style-type: none"> <li>- Inoperative ABS warning lamp bulb</li> <li>- Blown No.2 fuse (10A) in the engine compartment junction block</li> <li>- Inoperative ABS warning lamp module</li> <li>- Inoperative HECU</li> </ul>

**INSPECTION PROCEDURES****PROBLEM VERIFICATION**

Disconnect the connector from the ABS control module and turn the ignition switch ON.

Does the ABS warning lamp light up?

**YES**

It is normal. Recheck the ABS control module.

**NO**

Check the power source for the ABS warning lamp.

**CHECK THE POWER SOURCE FOR THE ABS WARNING LAMP**

1. Disconnect the instrument cluster connector and turn the ignition switch ON.
2. Measure the voltage between terminal 13 of the cluster harness side connector and body ground.

Specification: approximately B+

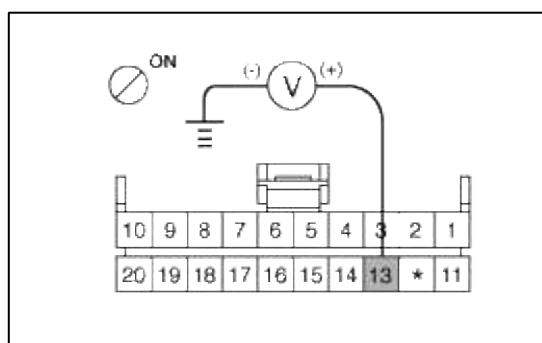
Is voltage within specification?

**YES**

Repair bulb or instrument cluster assembly.

**NO**

Check for blown fuse.

**CHECK FOR BLOWN FUSE**

Check continuity of fuse (10A) from the engine compartment junction block.

Is there continuity?

**YES**

Repair an open in the wire between ABS fuse and 13 of cluster connector.

**NO**

Replace the blown fuse.

## Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

### DETECTING CONDITION

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	<ul style="list-style-type: none"> <li>- An open in the wire</li> <li>- Inoperative instrument cluster assembly</li> <li>- Inoperative ABS warning lamp module</li> <li>- Inoperative HECU</li> </ul>

### INSPECTION PROCEDURES

#### CHECK DTC OUTPUT.

1. Connect the Scan Tool to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using Scan Tool.

Is DTC output?

**YES**

Repair circuit indicated by code output.

**NO**

Check instrument cluster.

#### CHECK INSTRUMENT CLUSTER

Disconnect the cluster connector and turn the ignition switch ON.

Does the ABS warning lamp remains ON?

**YES**

Replace the instrument cluster.

**NO**

Check for short to B+ in the wire.

#### CHECK FOR BATTERY VOLTAGE IN THE WIRE

Check for continuity in the wire between cluster and ABS control module.

Is there continuity?

**YES**

Replace the ABS control module and recheck.

**NO**

Repair an open in the wire between cluster and ABS control module.

#### BLEEDING OF BRAKE SYSTEM

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

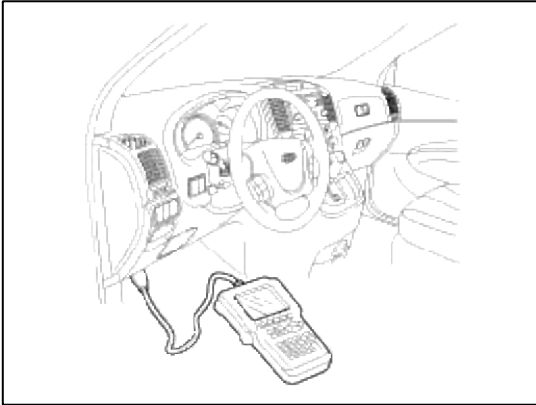
#### CAUTION

If there is any brake fluid on any painted surface, wash it off immediately.

#### NOTE

When pressure bleeding, do not depress the brake pedal.  
Recommended fluid..... DOT3 or DOT4

2. Connect a clear plastic tube to the brake caliper bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the scan tool to the data link connector located underneath the dash panel.

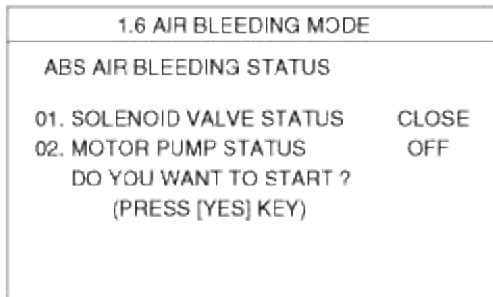


4. Select and operate according to the instructions on the scan tool screen.

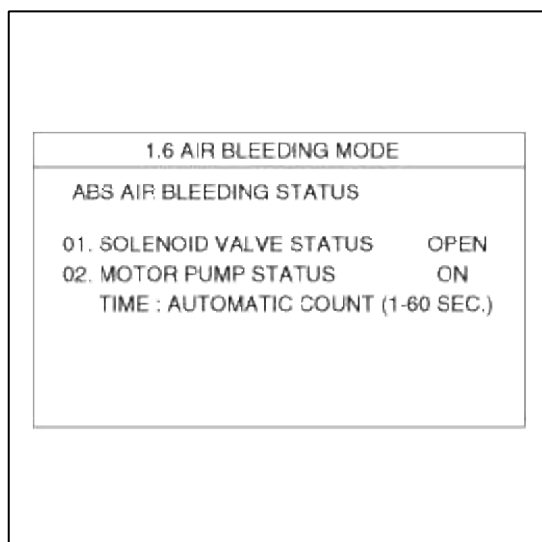
**CAUTION**

You must obey the maximum operating time of the ABS motor with the scan tool to prevent the motor pump from burning.

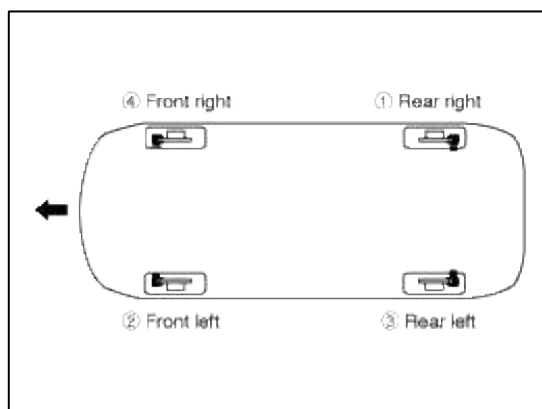
- (1) Select Kia vehicle diagnosis.
- (2) Select vehicle name.
- (3) Select Anti-Lock Brake system.
- (4) Select air bleeding mode.
- (5) Press "YES" to operate motor pump and solenoid valve.



(6) Wait 60 sec. before operating the air bleeding again. (If not, you may damage the motor.)



5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Start with bleeder screw furthest away from master cylinder. Then close the bleeder screw.
6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

Bleed screw tightening torque:

7~13 Nm (0.7 ~1.3 kgf·m, 5.1 ~ 9.4 lb-ft)

#### DIAGNOSTIC TROUBLE CODE CHART(DTC)

● : MIL ON ○ : MIL OFF

DTC CODE	Trouble description	Warning lamp condition			Etc.
		EBD	ABS	ESC	
C1101	Battery voltage high	●	●	●	
C1102	Battery voltage low	○/●	●	●	
C1200	Wheel speed sensor front-LH open/short	○/●	●	●	
C1201	Wheel speed sensor front-LH range / performance / intermittent	○/●	●	●	
C1202	Wheel speed sensor front-LH invalid/no signal	○/●	●	●	
C1203	Wheel speed sensor front-RH open/short	○/●	●	●	
C1204	Wheel speed sensor front-RH range / performance / intermittent	○/●	●	●	

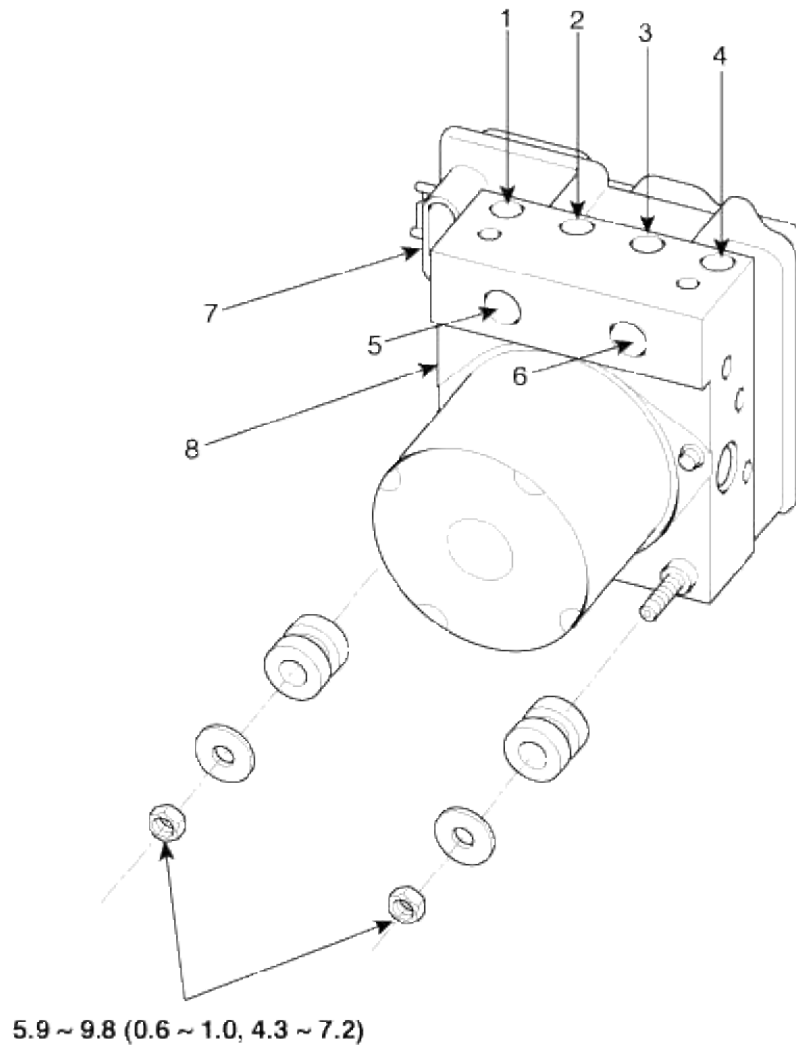


C1205	Wheel speed sensor front-RH invalid/no signal	○/●	●	●	
C1206	Wheel speed sensor rear-LH open/short	○/●	●	●	
C1207	Wheel speed sensor rear-LH range / performance / intermittent	○/●	●	●	
C1208	Wheel speed sensor rear-LH invalid/no signal	○/●	●	●	
C1209	Wheel speed sensor rear-RH open/short	○/●	●	●	
C1210	Wheel speed sensor rear-RH range / performance / intermittent	○/●	●	●	
C1211	Wheel speed sensor rear-RH invalid/no signal	○/●	●	●	
C1213	Wheel speed frequency error	○/●	●	●	
C1235	Primary pressure sensor-electrical	○	●	●	ESC only
C1237	Primary pressure sensor-signal	○	●	●	ESC only
C1260	Steering angle sensor-signal	○	○	●	ESC only
C1261	Steering angle sensor not calibrated	○	○	●	ESC only
C1274	Longitudinal G sensor error	○	●	-	ABS 4WD(EST)
C1275	Longitudinal G sensor Range/Performance error	○	●	-	ABS 4WD(EST)
C1282	Yaw rate & lateral G sensor-electrical	○	○	●	ESC only
C1283	Yaw rate & lateral G sensor-signal	○	○	●	ESC only
C1503	ESC switch error	○	○	●	ESC only
C1513	Brake switch error	○	●	●	ESC only
C1604	ECU(brake system) hardware error	●	●	●	
C1605	CAN hardware error	○	○	●	ESC only
C1611	CAN time-out EMS	○	○	●	ESC only
C1612	CAN time-out TCM	○	○	●	ESC only
C1616	CAN bus off	○	○	●	ESC only
C1623	CAN time-out SAS	○	○	●	ESC only
C1625	CAN time-out ESC	○	○	●	ESC only
C1626	Implausible Control	○	●	●	ESC only
C1627	CAN time-out 4WD	○	○	●	4WD
C1702	Variant Coding	●	●	●	ABS TOD, ESC only
C2112	Valve relay error	○/●	●	●	
C2308	Front-LH Valve error (Inlet valve)	●	●	●	
C2312	Front-LH Valve error (Outlet valve)	●	●	●	
C2316	Front-RH Valve error (Inlet valve)	●	●	●	
C2320	Front-RH Valve error (Outlet valve)	●	●	●	

C2324	Rear-LH Valve error (Inlet valve)	●	●	●	
C2328	Rear-LH Valve error (Outlet valve)	●	●	●	
C2332	Rear-RH Valve error (Inlet valve)	●	●	●	
C2336	Rear-RH Valve error (Outlet valve)	●	●	●	
C2366	USV1 error	●	●	●	ESC only
C2370	USV2 error	●	●	●	ESC only
C2372	HSV1 error	●	●	●	ESC only
C2374	HSV2 error	●	●	●	ESC only
C2402	Motor electrical	●	●	●	

**Brake System > ABS(Anti-Lock Brake System) > ABS Control Unit > Components and Components Location**

**COMPONENTS**



**TORQUE : Nm (Kgf.m, lb-ft)**

- |                       |                                       |
|-----------------------|---------------------------------------|
| 1. Front - right tube | 5. Master cylinder tube2              |
| 2. Rear - left tube   | 6. Master culinder tube1              |
| 3. Rear - right tube  | 7. ABS control module connector (26P) |
| 4. Front - left tube  | 8. ABS control module (HECU)          |

**Brake System > ABS(Anti-Lock Brake System) > ABS Control Unit > Repair procedures**

**REMOVAL**

1. Disconnect the battery(-) terminal.

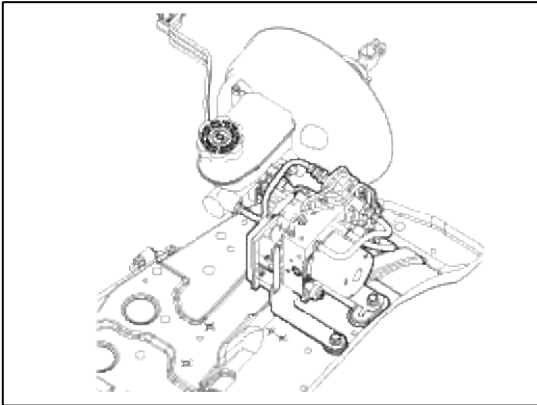
2. Disconnect the brake tubes from the HECU.

---

**Tightening torque Nm (kgf.m, lb-ft):**

5.9 ~ 9.8 (0.6 ~ 1.0, 4.3 ~ 7.2)

---



3. Disconnect the HECU connector.

4. Remove the HECU by loosening the bracket mounting bolts.

---

**Tightening torque Nm (kgf.m, lb-ft):**

16.7 ~ 25.5 (1.7 ~ 2.6, 12.3 ~ 18.8)

---

**CAUTION**

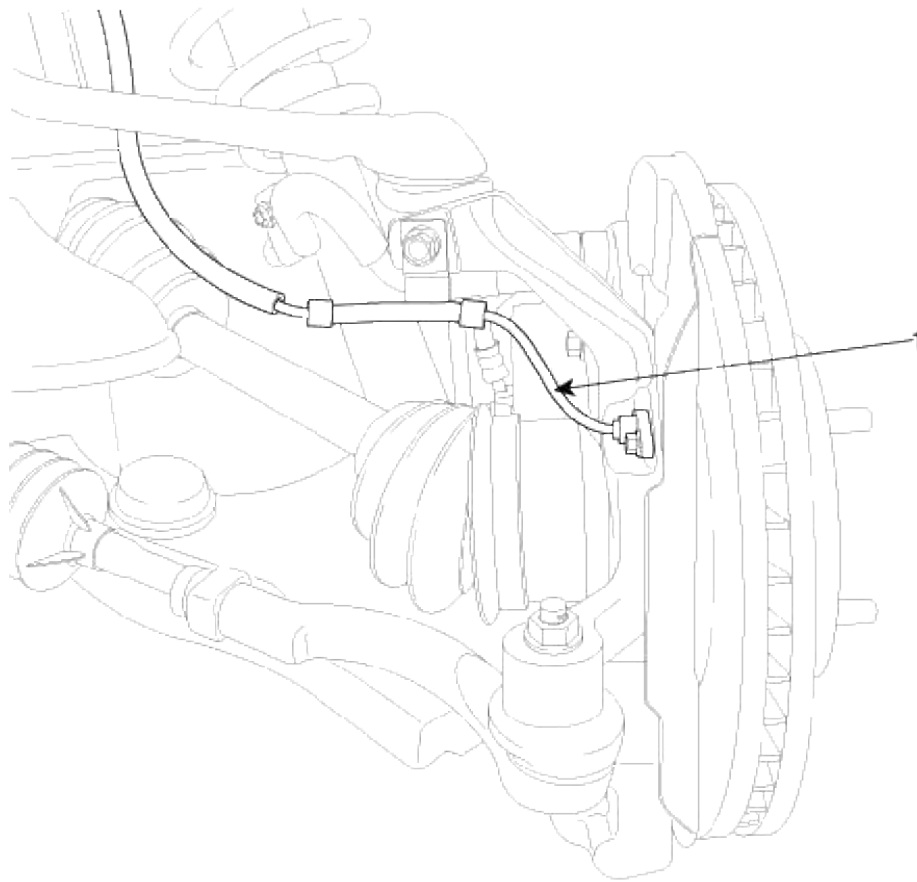
- Never attempt to disassemble the HECU.
- The HECU must be protected during storage and transport, and must not be subjected to excessive shock.

## INSTALLATION

1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to ABS bleeding)

**Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Components and Components Location**

## COMPONENTS



1. Front wheel speed sensor

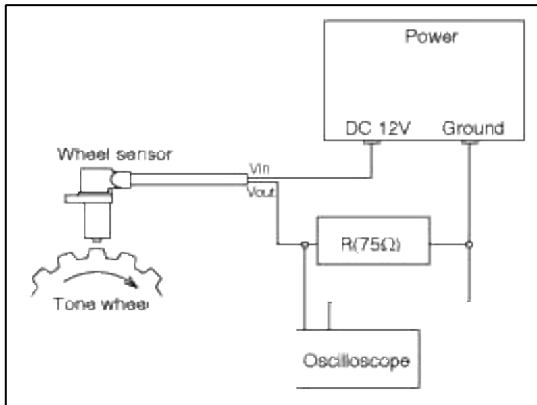
**Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Repair procedures**

INSPECTION

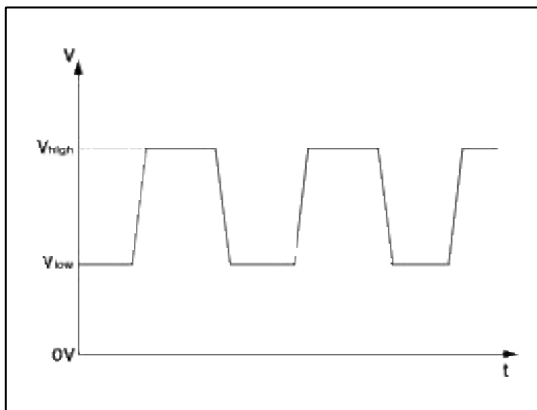
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

**CAUTION**

In order to protect the wheel speed sensor, when measuring output voltage, a  $75\Omega$  resistor must be used as shown.



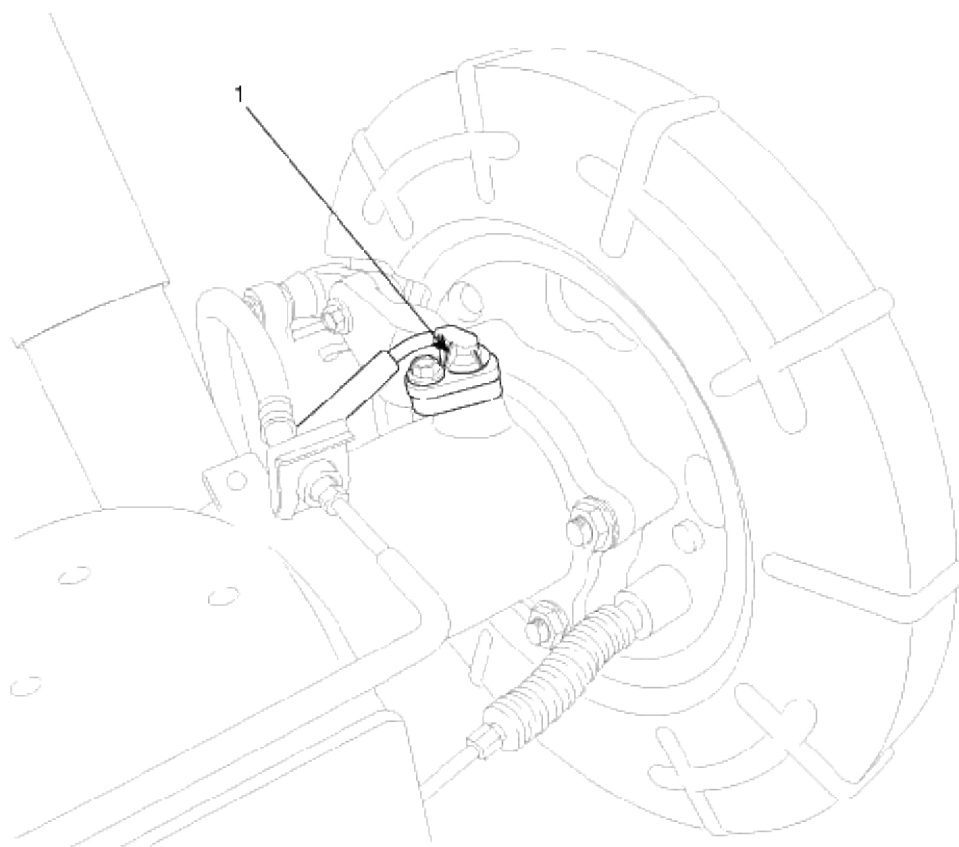
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



- A.  $V_{low}$  : 0.44 V ~ 0.63 V
- B.  $V_{high}$  : 0.885 V ~ 1.26 V
- C. Frequency range : 1~2,500 Hz

**Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Components and Components Location**

**COMPONENTS**



1. Rear wheel speed sensor

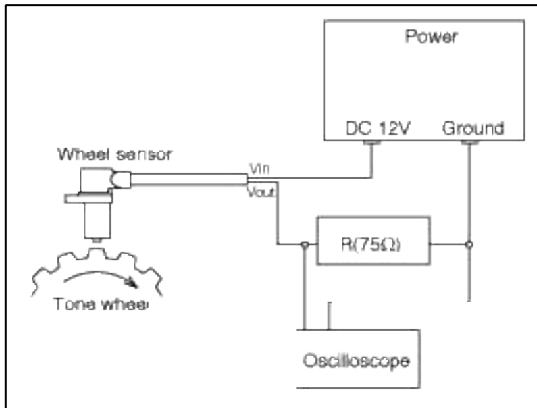
**Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Repair procedures**

INSPECTION

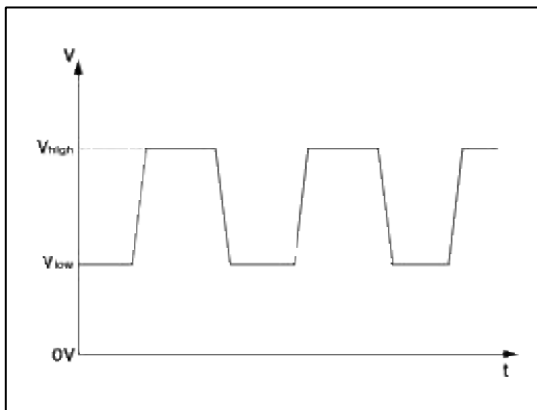
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

**CAUTION**

In order to protect the wheel speed sensor, when measuring output voltage, a  $75\Omega$  resistor must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

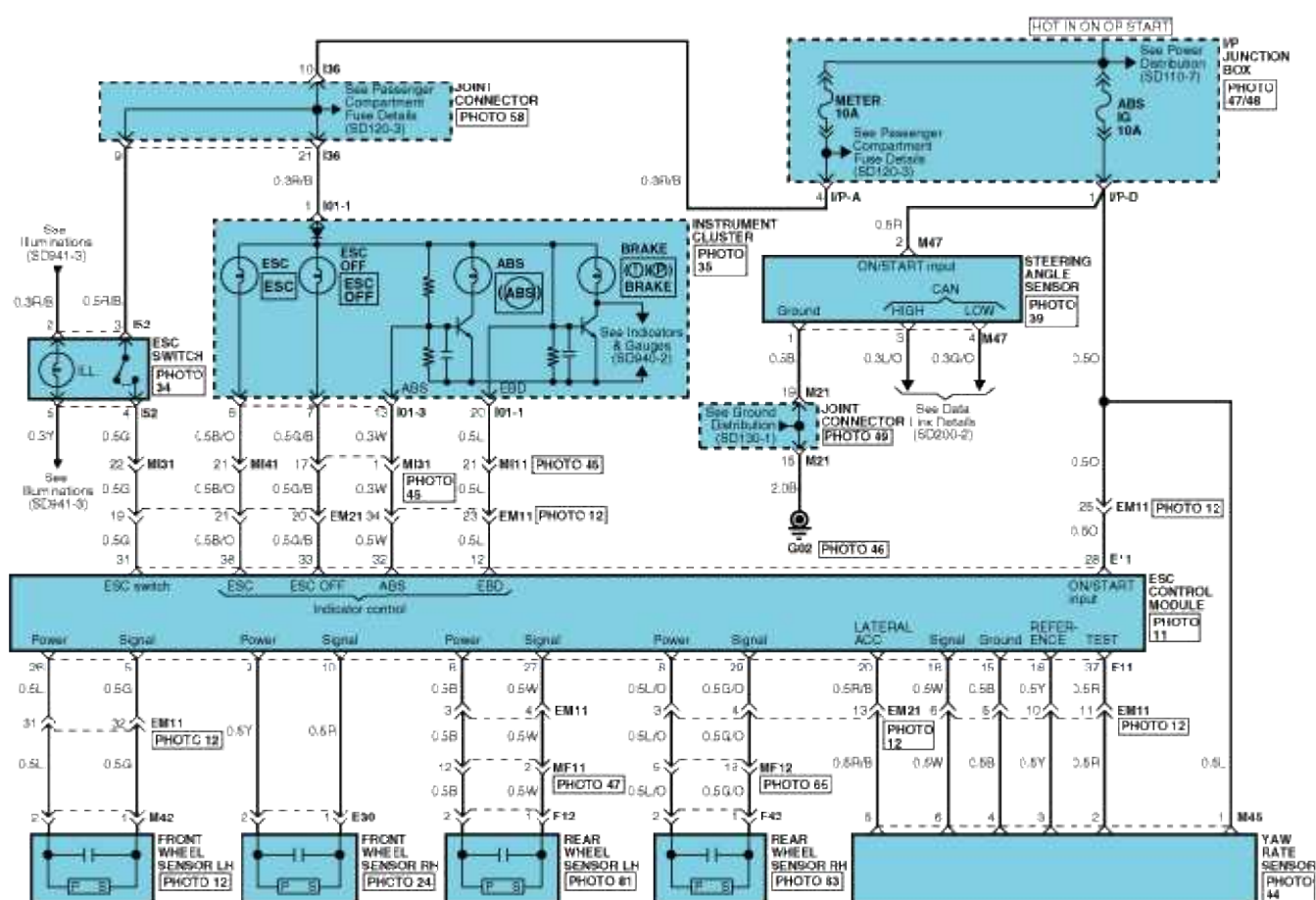


- A.  $V_{low}$  : 0.44 V ~ 0.63 V
- B.  $V_{high}$  : 0.885 V ~ 1.26 V
- C. Frequency range : 1~2,500 Hz

**Brake System > ESP(Electronic Stability Program) System > Schematic Diagrams**

ESC circuit DIAGRAM(1)

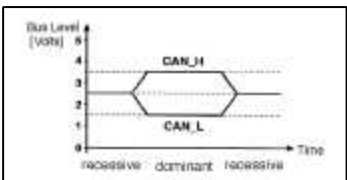




### ESC circuit DIAGRAM(2)

Diagram illustrating the instruction format (32 bits total):

- Field 1 (4 bits): 1, 2, 3, 4
- Field 2 (16 bits): 5, 6, \*, 8, 9, 10, 11, 12, 13, 14, 15, 16, \*, 18, \*, 20, \*, \*, \*, \*, \*
- Field 3 (16 bits): 26, 27, 28, 29, 30, 31, 32, 33, \*, 35, \*, 37, 38, \*, \*, \*, \*, \*, \*, \*
- Field 4 (4 bits): 39, 40, 41, 42

Connector Terminal		Specifications	Conditions
No	Description		
1	Ground(Pump)	Current range : Min-10 A Max-20 ~ 39 A	Always
4	Ground(Valve,ECU)	Current range : Min-2.5 A Max-5 ~ 15 A	Always
2	Supply voltage(Pump)	Battery voltage	Always
3	Supply voltage(Valve)		
26	Wheel sensor voltage(FL)	Battery voltage	IG ON
9	Wheel sensor voltage(FR)		
6	Wheel sensor voltage(RL)		
8	Wheel sensor voltage(RR)		
5	Wheel sensor signal(FL)	Voltage(High) : 0.89~1.26 V Voltage(Low) : 0.44~0.63 V	RUNNING
10	Wheel sensor signal(FR)		
27	Wheel sensor signal(RL)		
29	Wheel sensor signal(RR)		
11	Diagnosis Input/oupput	Voltage(High) : 0.8 * IG ON more Voltage(Low) : 0.2 * IG ON lower	SCAN TOOL Communication
28	Ignition	Battery voltage	KEY ON/OFF
31	ESC Passive switch	Voltage(High) : 0.6 * IG ON more Voltage(Low) : 0.4 * IG ON lower	Switch ON/OFF
37	Yaw Rate Sensor Test	Voltage(High) : 4.1 V more Voltage(Low) : 1 V lower	IG ON
18	Yaw Rate Sensor Reference	2.464 V ~ 2.536 V	IG ON
16	Yaw Rate Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V(-100 ~ 100 °/s)	IG ON
20	Acceleration Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V(-1.8 g ~ 1.8 g)	IG ON
15	Yaw Rate Sensor Ground	GND LEVEL	Always
35	CAN High	not communicating:2.5 ± 0.5 V communication : 	IG ON
14	CAN Low		
30	BRAKE LIGHT SWITCH	voltage(High) : 0.8 * IG ON more voltage(Low) : 0.3 * IG ON lower	BRAKE ON/OFF

## Brake System > ESP(Electronic Stability Program) System > Description and Operation

### description of ESC

Optimum driving safety now has a name : ESC, the Electronic Stability Control.

ESC recognizes critical driving conditions, such as emergency reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no need for actuating the brake or the gas pedal.

ESC adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESC functions.

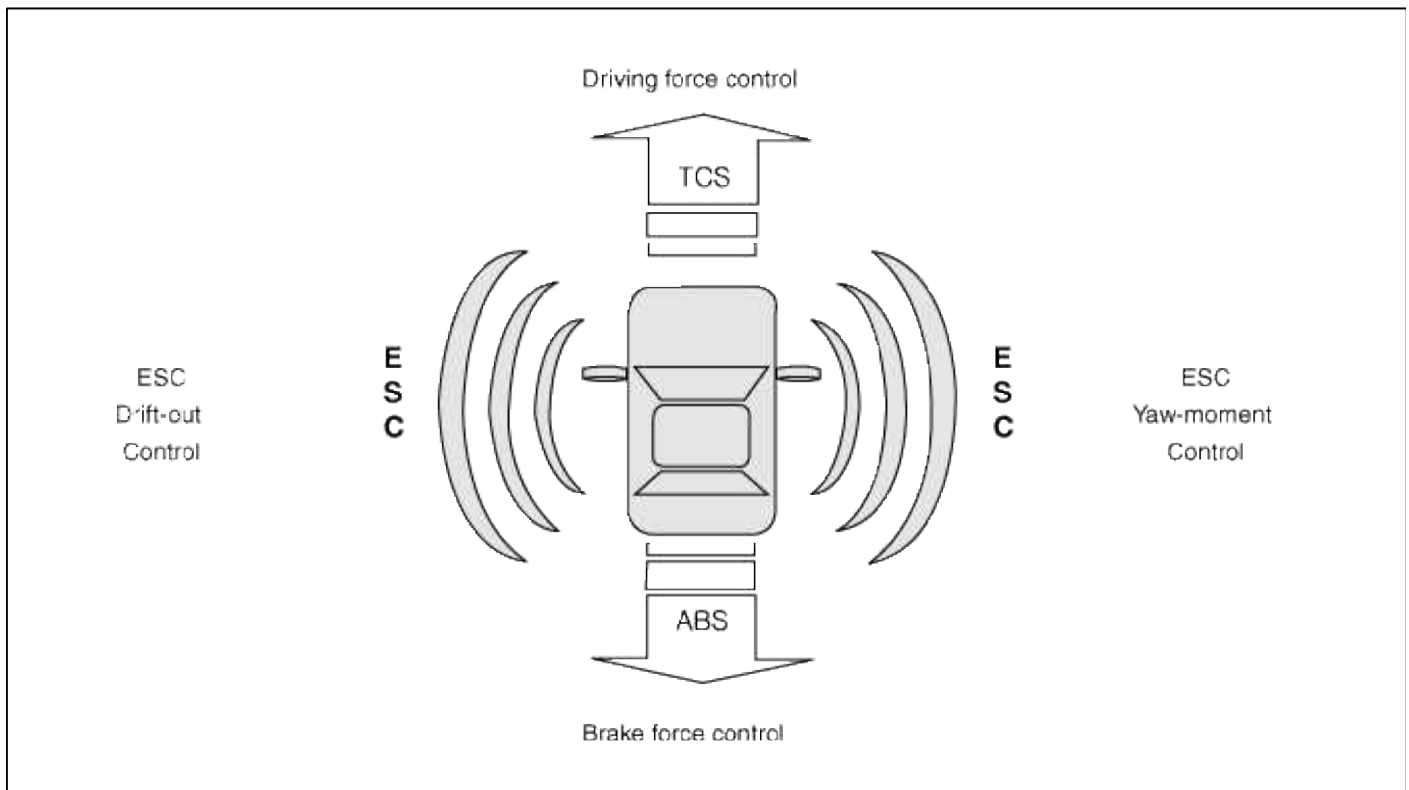
Whereas the ABS/TCS function controls wheel slip during braking and engine control intervention.

This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.

ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.

Of course, the stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESC function in response to a command by the driver.

In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



### DESCRIPTION OF ESC CONTROL

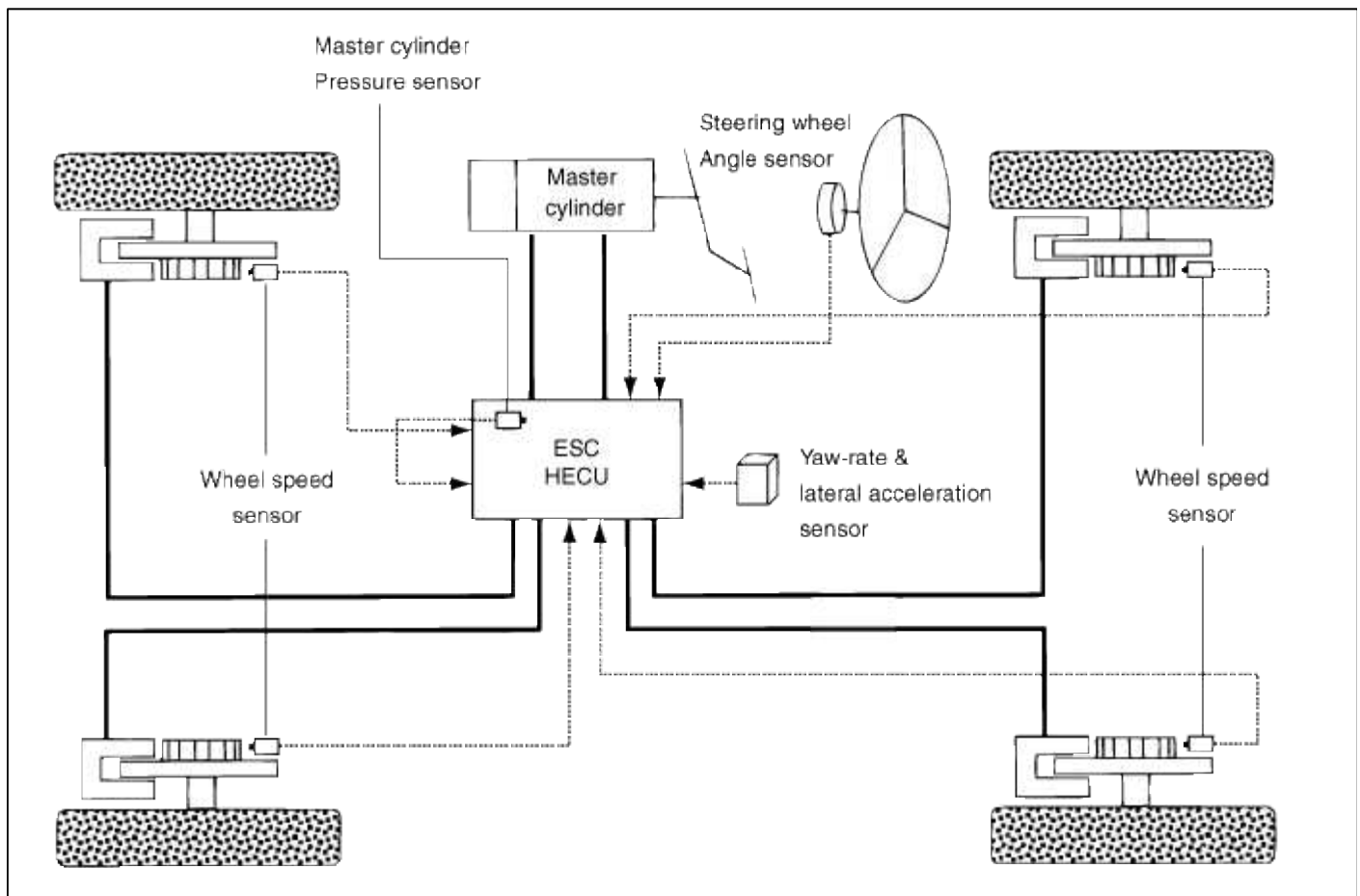
ESC system includes ABS/EBD, TCS and AYC (Active yaw control) function.

**ABS/EBD function :** The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square waveform. By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels. And, the ECU judges whether the ABS/EBD should be actuated or not.

**TCS function** prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication. TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.

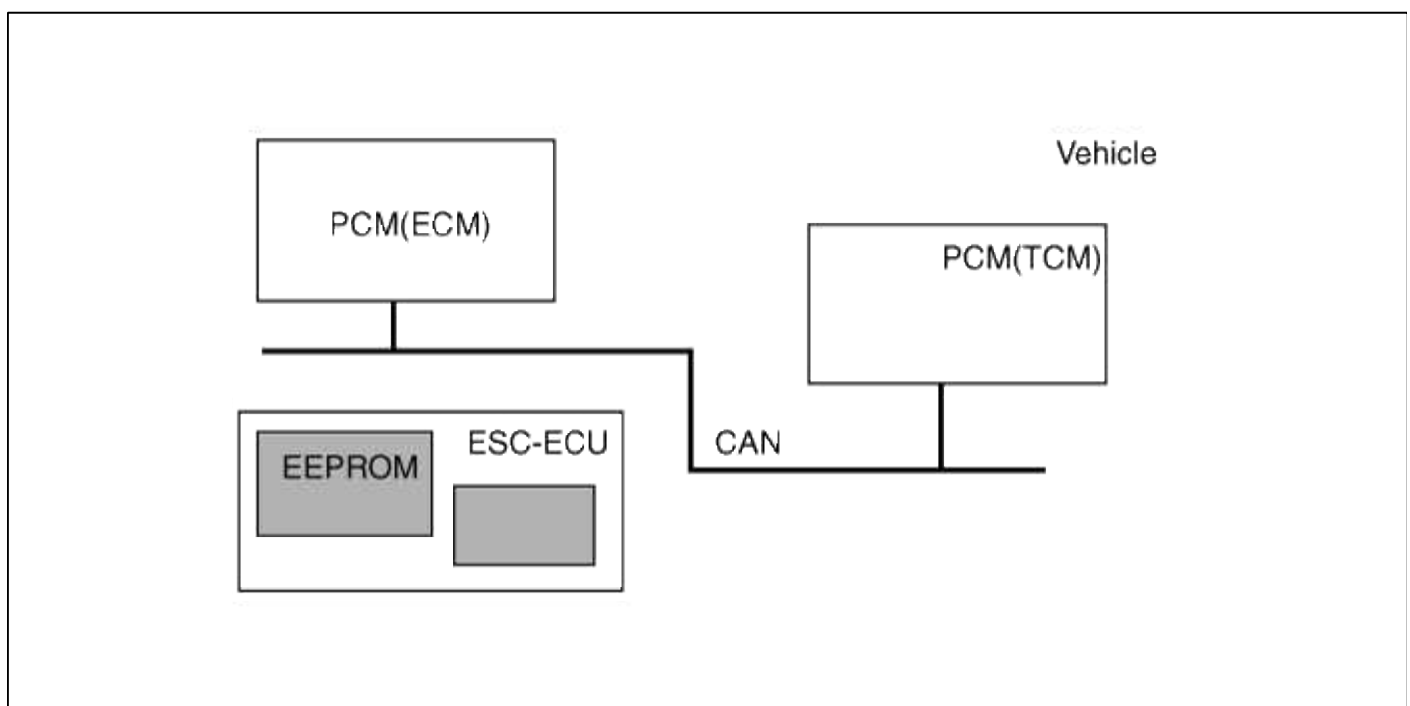
**AYC function** prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals (Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor). If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.

After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis) If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESC warning lamp. (fail-safe warning)



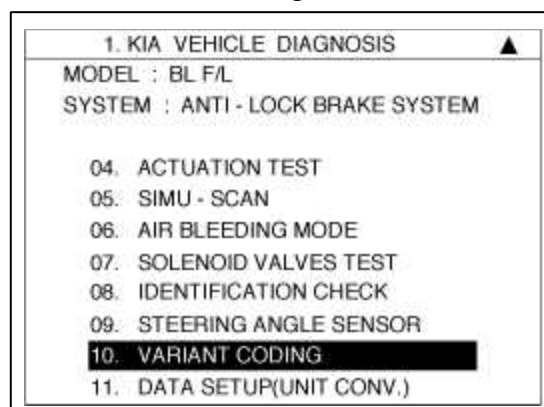
### VARIANT CODING

The HECU is programmed with a variant code based on the vehicle powertrain configuration. This variant code is used to determine the appropriate ESC calculations. Variant code programming should be performed whenever an HECU is replaced.

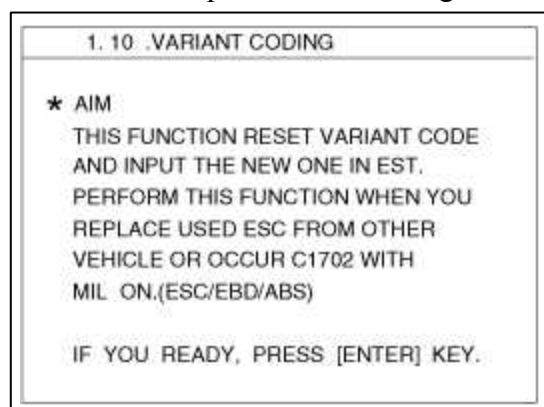


### PROCEDURE OF VARIANT CODING

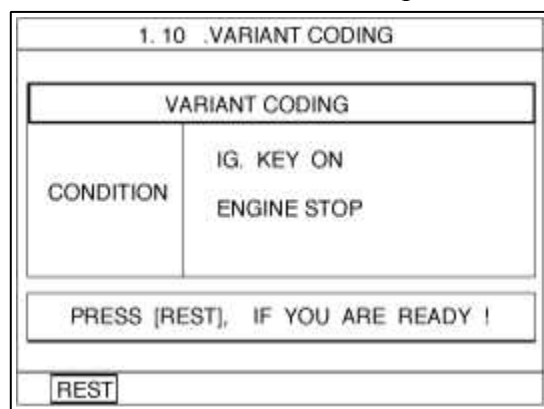
1. Connect the scan tool to the data link connector located underneath the dash panel. Turn ign key to the ON position
2. Select vehicle name.
3. Select ANTI-LOCK BRAKE SYSTEM.
4. Select the variant coding.



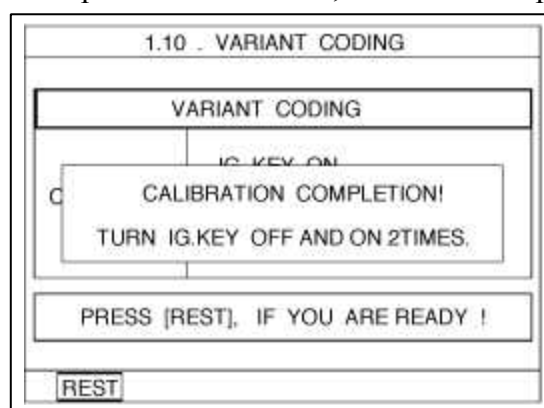
5. Follow the next procedure according to the comment .



6. Confirm the condition , and then push the "REST".



7. If the procedure is finished, the screen is displayed as shown below.



8. IGN off.

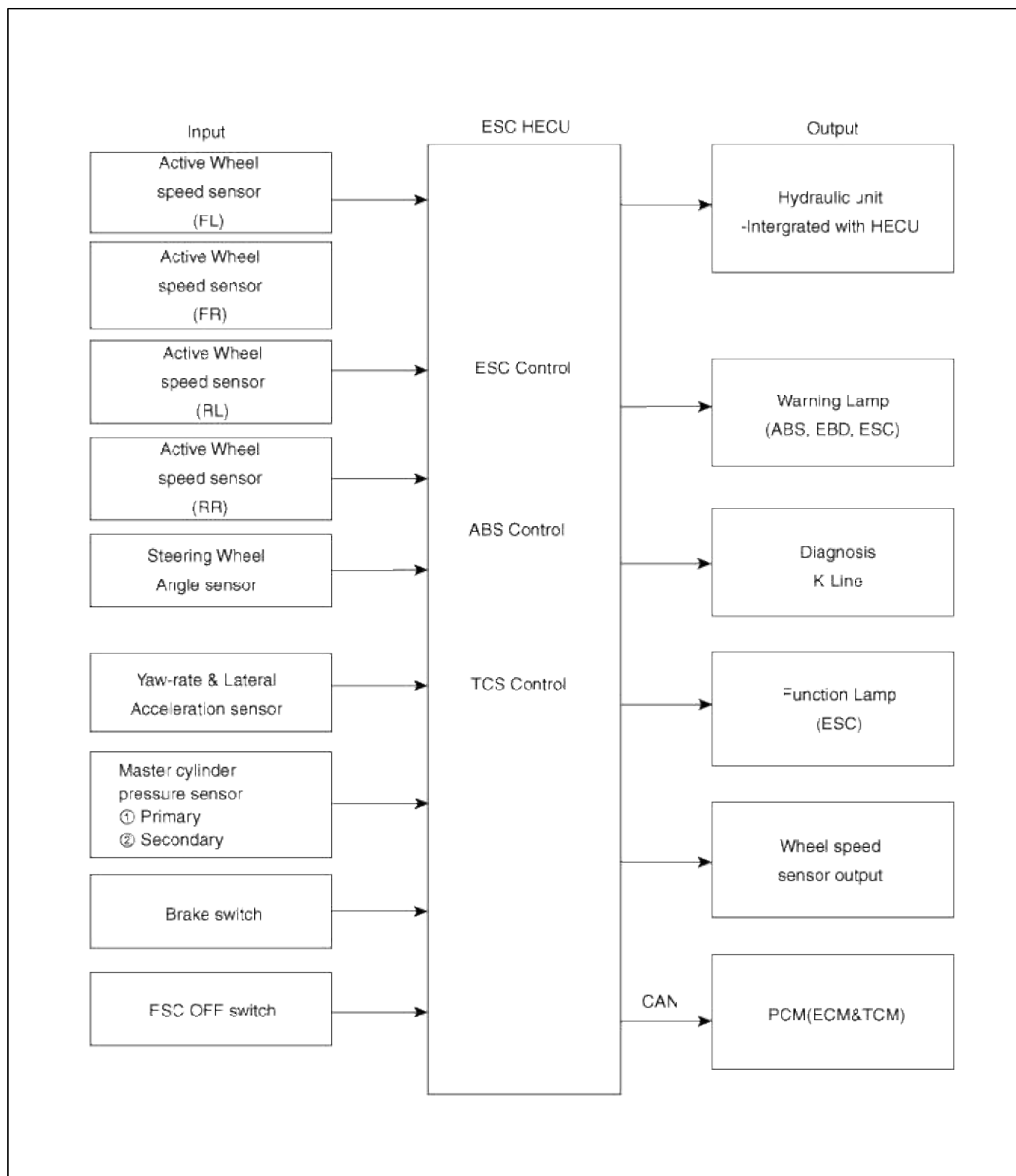
9. IGN on.

10. The variant coding is completed.

#### CAUTION

- If the warning lamp(ESC, EBD, ABS) is illuminated, follow the "Variant coding" again.
- For the vehicle equipped 4WD, delete the DTC(s) memorized in 4WD ECU when variant coding is completed.

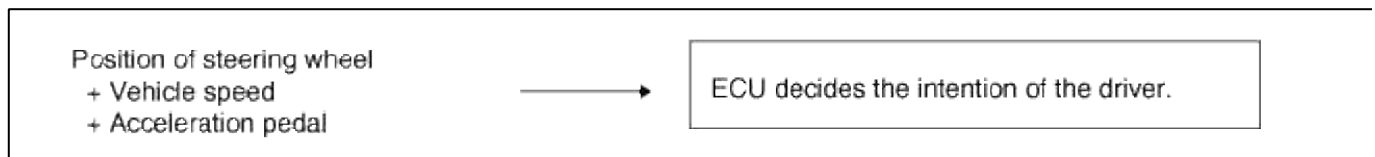
### INPUT AND OUTPUT DIAGRAM



## ESC OPERATION MODE

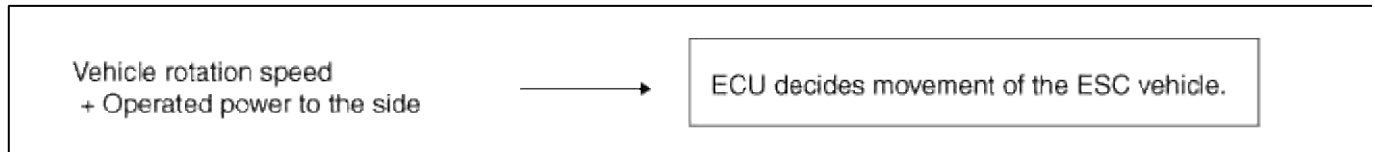
### 1. STEP 1

The ESC analyzes the intention of the driver.



### 2. STEP 2

It analyzes the movement of the ESC vehicle.



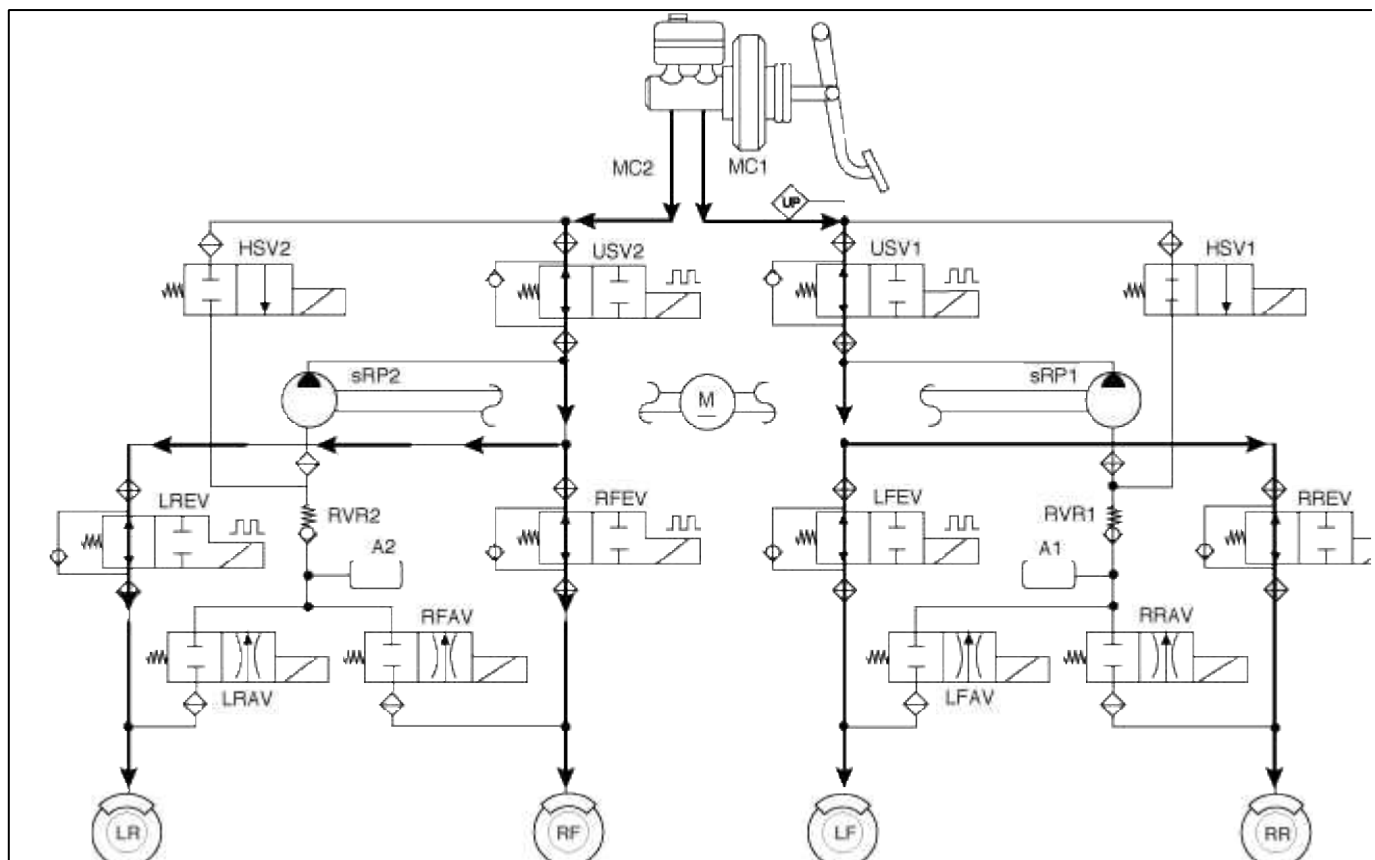
### 3. STEP 3

The HECU calculates the required strategy, then actuates the appropriate valves and sends torque control requests via CAN to maintain vehicle stability.

## ESC OPERATION MODE

### 1. ESC Non-operation-Normal braking.

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Open	Close	OFF



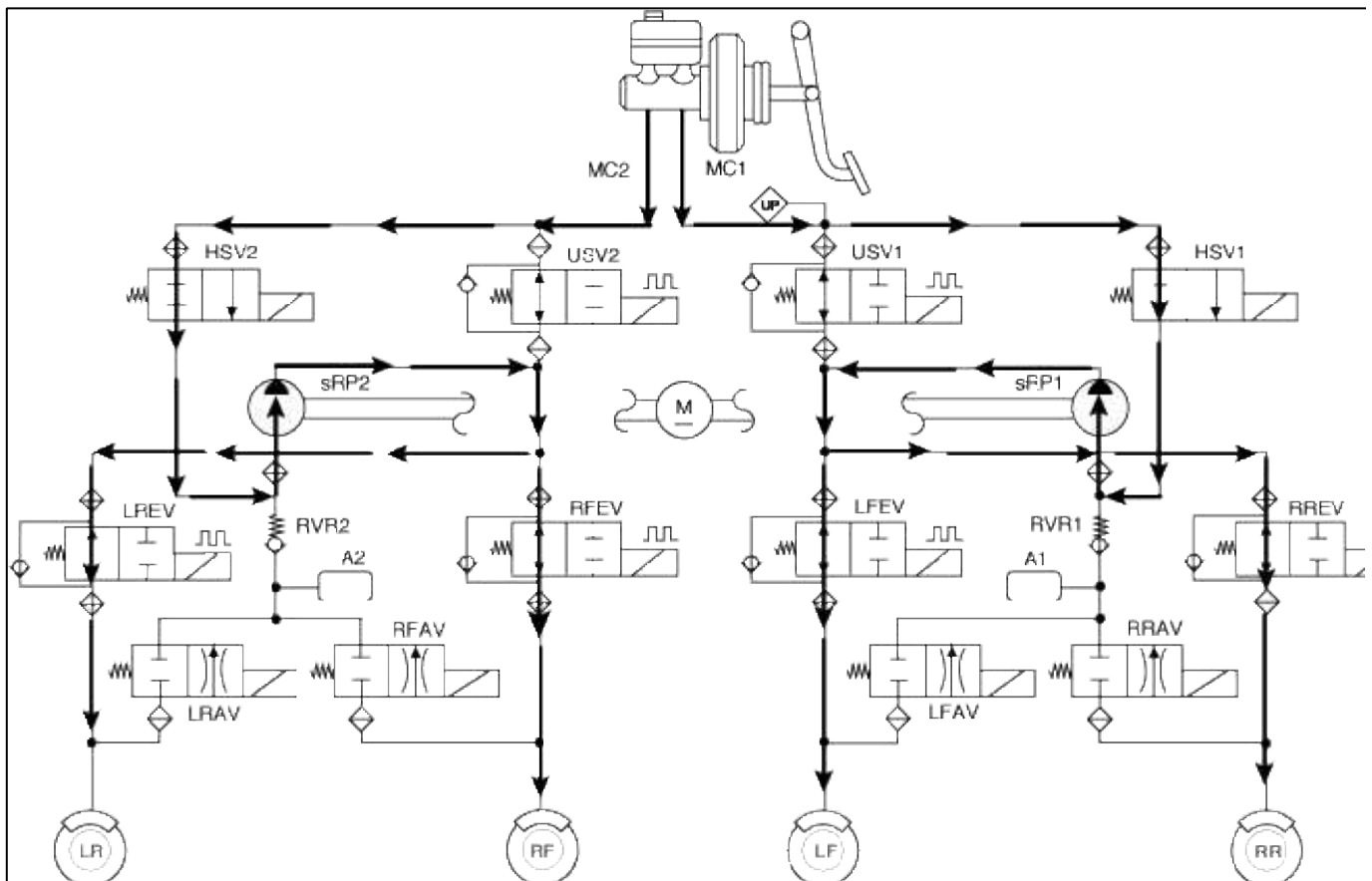


**NOTE**

EV : Inlet Valve  
 AV : Outlet Valve  
 LR : Rear left wheel  
 RF : Front right wheel  
 LF : Front left wheel  
 RR : Rear right wheel  
 PE : Pump motor  
 USV : Pilot Valve  
 HSV : High pressure Switch Valve

**2. ESC INCREASE MODE**

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Close(Partial)	Open	ON(Motor speed control)

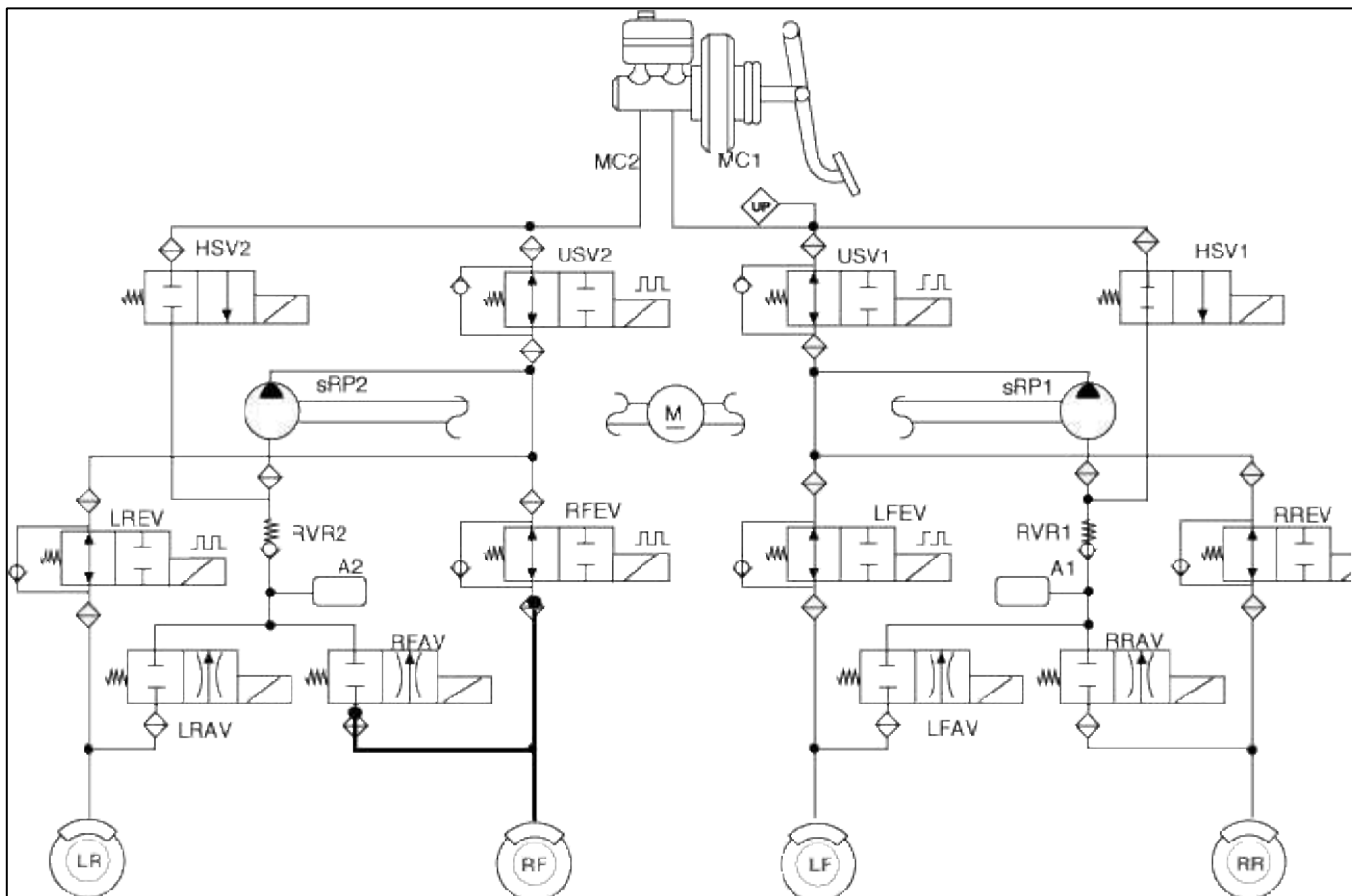


**NOTE**

EV : Inlet Valve  
 AV : Outlet Valve  
 LR : Rear left wheel  
 RF : Front right wheel  
 LF : Front left wheel  
 RR : Rear right wheel  
 PE : Pump motor  
 USV : Pilot Valve  
 HSV : High pressure Switch Valve

### 3. ESC HOLD MODE ( FR is only controlled.)

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Close	Close(Partial)	Open	ON(Motor speed low control)

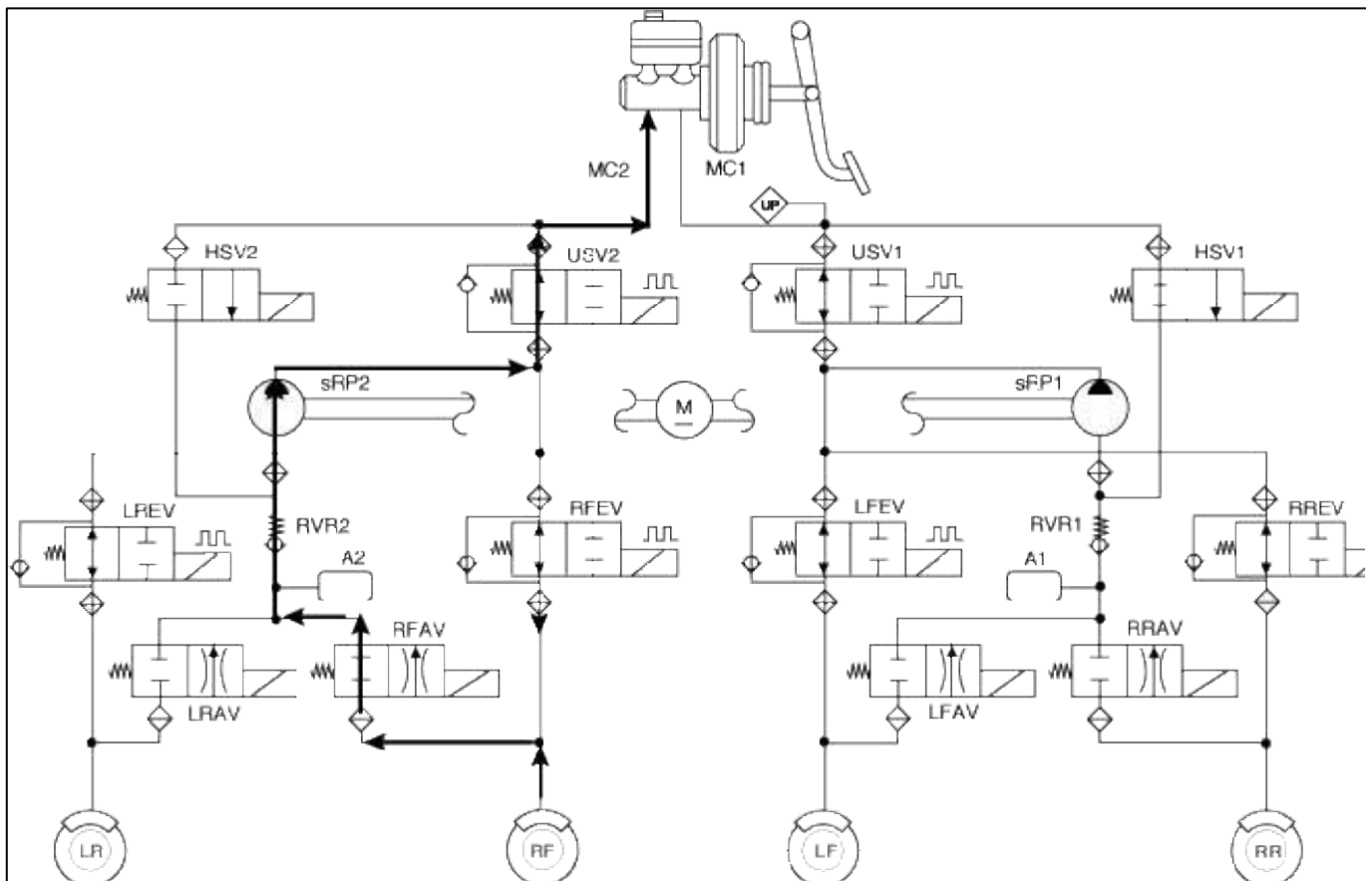


**NOTE**

EV : Inlet Valve  
 AV : Outlet Valve  
 LR : Rear left wheel  
 RF : Front right wheel  
 LF : Front left wheel  
 RR : Rear right wheel  
 PE : Pump motor  
 USV : Pilot Valve  
 HSV : High pressure Switch Valve

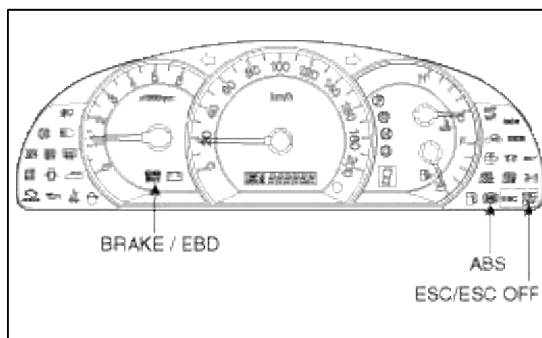
#### 4. ESC DECREASE MODE (FR is only controlled)

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Open	Close(Partial)	Open	ON(Motor speed low control)



**NOTE**

EV : Inlet Valve  
 AV : Outlet Valve  
 LR : Rear left wheel  
 RF : Front right wheel  
 LF : Front left wheel  
 RR : Rear right wheel  
 PE : Pump motor  
 USV : Pilot Valve  
 HSV : High pressure Switch Valve



### ABS Warning Lamp module

The active ABS warning lamp module indicates the self-test and failure status of the ABS. The ABS warning lamp may be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is separated from ECU.

### EBD/PARKING BRAKE WARNING LAMP MODULE

The active EBD warning lamp module indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order.
- During diagnostic mode.
- When the ECU Connector is separated from ECU.

### ESC Warning Lamp (ESC system)

The ESC warning lamp indicates the self-test and failure status of the ESC.

The ESC warning lamp may be turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESC functions by failure.
- When driver turn off the ESC function by on/off switch.
- During diagnostic mode.

### ESC Function Lamp (ESC system)

The ESC function lamp indicates the self-test and operating status of the ESC.

The ESC Function lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESC control is operating. (Blinking - 2Hz)

### ESC On/Off Switch (ESC system)

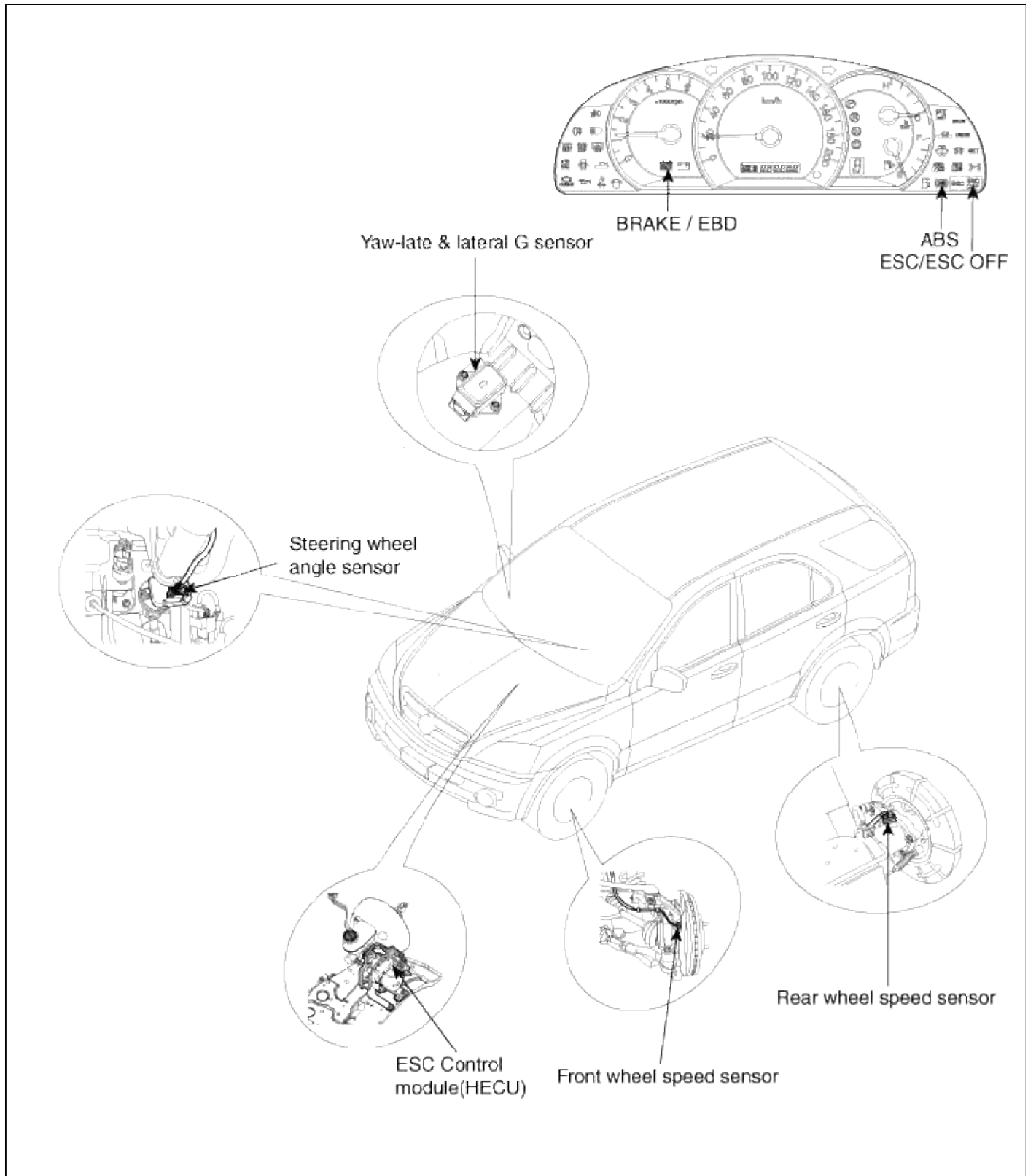
The ESC On/Off Switch shall be used to toggle the ESC function between On/Off states based upon driver input.

The On/Off switch shall be a normally open, momentary contact switch.

Initial status of the ESC function is on and the switch is used to request an ESC status change.

## Brake System > ESP(Electronic Stability Program) System > Components and Components Location

### COMPONENTS



## Brake System > ESP(Electronic Stability Program) System > Troubleshooting

### FAILURE DIAGNOSIS

1. In principle, ESC and TCS controls are prohibited in case of ABS failure.
2. When ESC or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESC failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESC is not installed.

### MEMORY OF FAIL CODE

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as long as the HCU power is on. (X)

### FAILURE CHECKUP

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.
4. Initial checkup is made in the following cases.
  - (1) When no failure is detected
  - (2) When ABS and ESC are not in control.
  - (3) Initial checkup is not made after ECU power on.
  - (4) If the vehicle speed is over 8 km/h(5 mph) when the brake lamp switch is off.
  - (5) When the vehicle speed is over 40 km/h(24.9 mph).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESC control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
  - (1) When the power is normal.
  - (2) From the point in which the vehicle speed reaches 8 km/h(5.0 mph) after HECU power on.

### COUNTERMEASURES IN FAIL

1. Shut the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Do not perform any ABS/TCS/ESC functions until normal operating condition is restored.

### WARNING LAMP ON

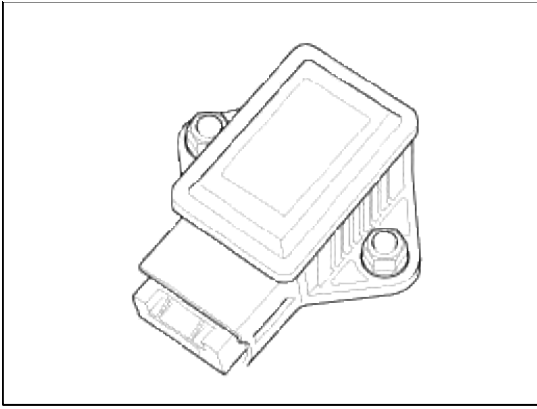
1. ABS warning lamp turns on when ABS is malfunctioning.
2. ESC operation lamp turns on when ESC is malfunctioning.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

## Brake System > ESP(Electronic Stability Program) System > Yaw-rate and Lateral G Sensor > Description and Operation

### DESCRIPTION

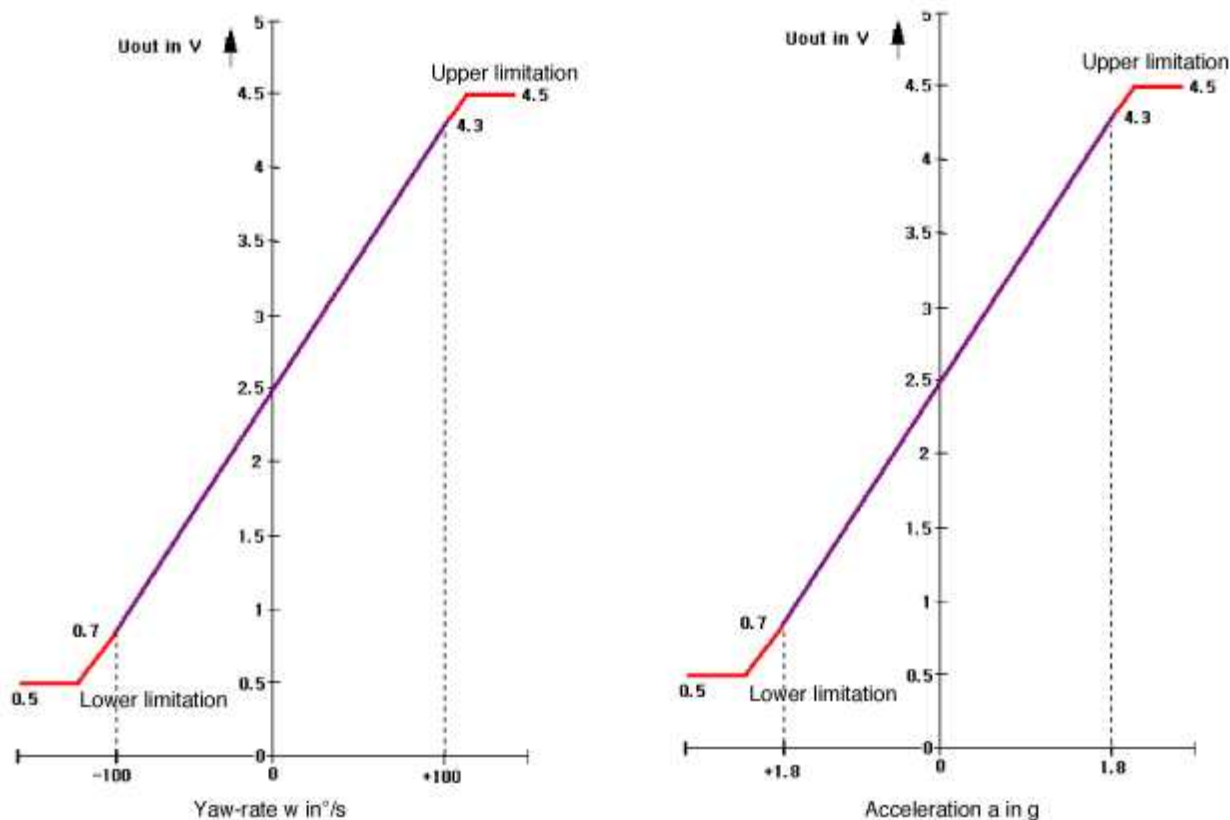
1. The yaw-rate & lateral G sensor is applied for the ESC system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the crash pad lower floor on vehicle.



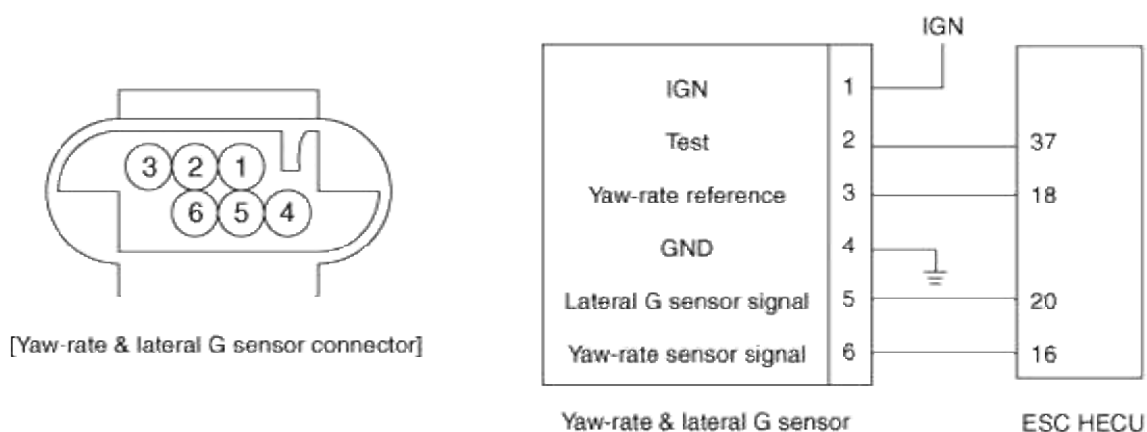
## SPECIFICATION

Description			Specification	Remark
Nominal supply voltage			11.5 ~ 12.5 V	
Supply voltage range			8 ~ 16 V	
Supply current			Max. 120 mA	Typ. 75 mA
Reference Voltage Output			2.464 ~ 2.536 V	Typ. 2.5 V
Operating temperature range			-40 ~ 85°C (-40 ~ 185°F)	
Yaw-rate sensor	Measurement range	+w direction, left turn	Min.100 °/s	Typ. 111 °/S
		-w direction, right turn	Min.-100 °/s	Typ. -111 °/S
	Non-linearity		-1 ~ 1 %	
	Offset (within life,within operating temperature)		3.75 °/S	
	Upper cut-off frequency		Min. 45 Hz	Typ. 60 Hz
Lateral G sensor	Measurement range	+y direction, left turn	Min.1.8 g	Typ. 2 g
		-y direction, right turn	Min. -1.8 g	Typ. -2 g
	Non-linearity		-4 ~ 4 %	
	Offset (within life,within operating temperature)		-0.09 ~ 0.09 g	
	Upper cut-off frequency		Min. 20 Hz	Typ. 40 Hz

## OUTPUT CHARACTERISTIC



### CIRCUIT DIAGRAM (YAW-RATE & LATERAL G SENSOR)



### Brake System > ESP(Electronic Stability Program) System > ESP OFF Switch > Description and Operation

#### DESCRIPTION

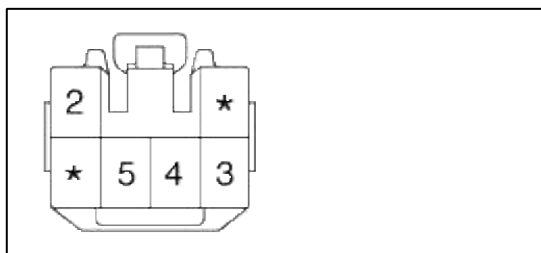
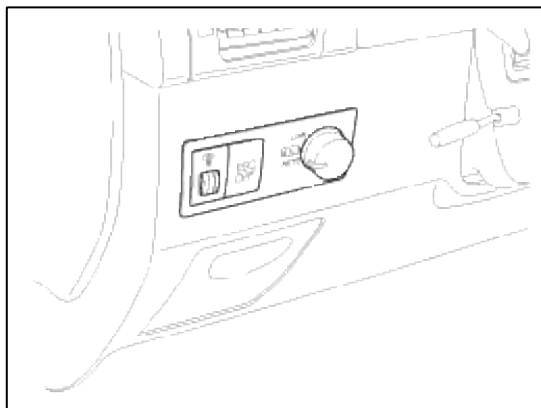
1. The ESC OFF switch is for the user to turn off the ESC system.
2. The ESC OFF lamp is on when ESC OFF switch is engaged.

### Brake System > ESP(Electronic Stability Program) System > ESP OFF Switch > Repair procedures

#### INSPECTION



1. Remove the ESC OFF switch from the switch panel on the crash pad of the driver's side.



2. Check the continuity between the switch terminals as the ESC OFF switch is engaged. (Refer to circuit diagram)

## Brake System > ESP(Electronic Stability Program) System > Steering Angle Sensor > Description and Operation

### DESCRIPTION

#### GENERAL DATA

The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.

#### MEASURING PRINCIPLE

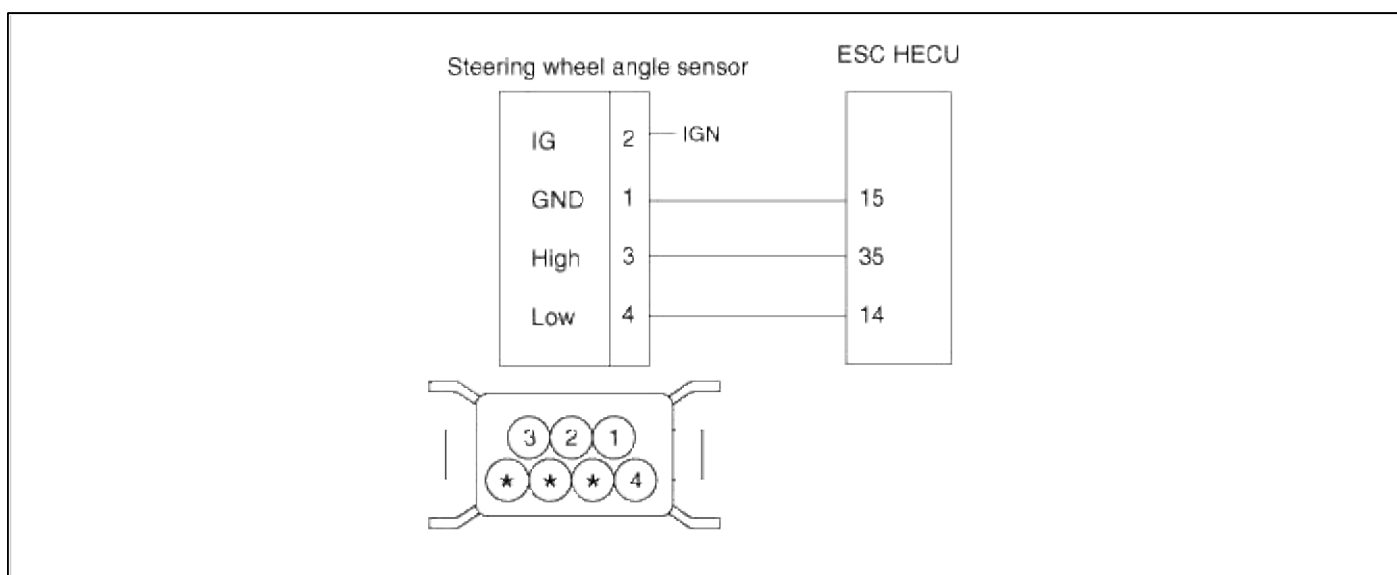
A non contact, analog angle sensor carrying out absolute measuring by the use of the Anisotropic-Magneto-Resistive effect (AMR). Measuring of the absolute angle by means of a toothed measuring gear with magnetic properties in combination with different ratios. Corresponding AMR elements that change their electrical resistance according to the magnetic field direction detect the angle position of the measuring gears. A micro-controller decodes the measured voltage signals after A/D converting with the help of a mathematical function. Output of the digital angle value and velocity via CAN-interface.

#### SPECIFICATION

Description		Specification
Operating voltage		8~16 V
Operating temperature		-40 ~ 85 °C (-40 ~ 185°F)
Current consumption		Max.150 mA
Steering angle velocity		Max. $\pm 2000$ °/sec
Connection delay time		$t < 200$ ms
Reverse voltage		-13.5 V
Measuring range	Angle	-780 ° ~ 779 °
	Angular velocity	0~ 1016 °/s
Nonlinearity angle		-2.5 ° ~ +2.5 °

Hysteresis angle	0 ° ~ 5 °
Rotational friction torque measuring	10 °/s

### CIRCUIT DIAGRAM( STEERING WHEEL SPEED ANGLE SENSOR)

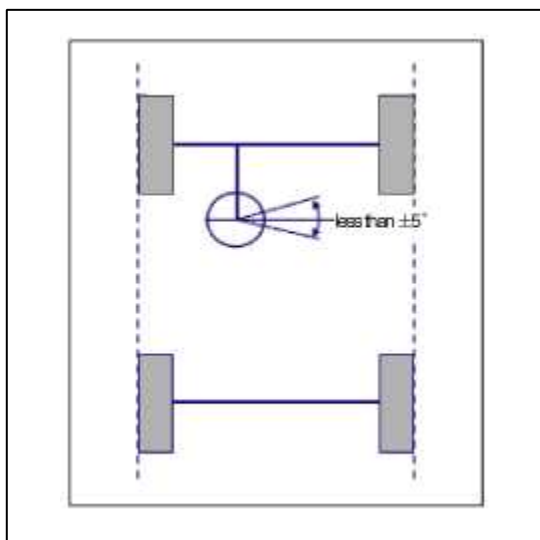


### STEERING ANGLE SENSOR (SAS) calibration

#### 1. PURPOSE OF calibration

- On vehicle control, an ESC analyzes the intention of the driver.
- An ESC recognizes a steering angle which a driver rotates through the steering angle sensor.
- A steering angle sensor used in ESC adjusts 0° setting of steering wheel through K-line or CAN communication.

#### 2. STEERING ANGLE SENSOR (SAS) CALIBRATION METHOD



(1) Align the wheel to the straight line. (steering wheel  $< \pm 5^\circ$  )

ex) Perform the wheel alignment first.

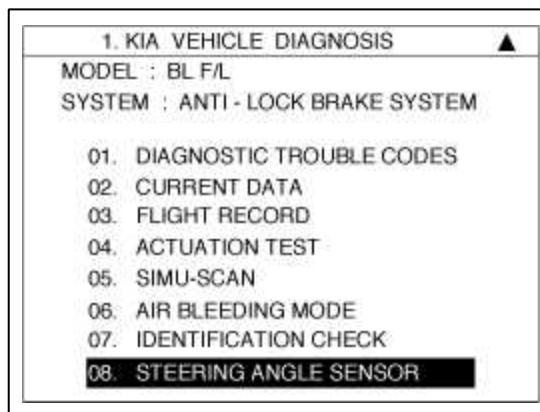
Align the wheel to the straight line.

A driver moves the vehicle to the front and back about 5 meters twice or three times.

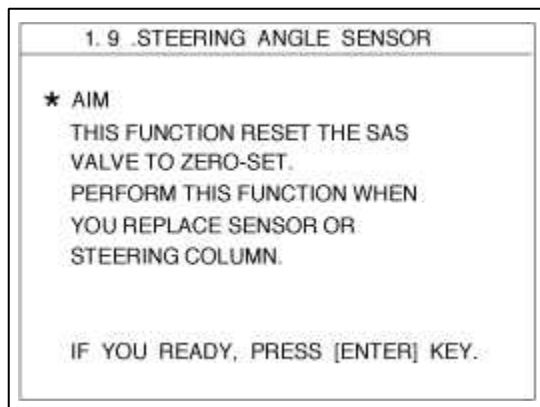
(2) Connect Scan tool to the vehicle.

(3) Select Brake system.

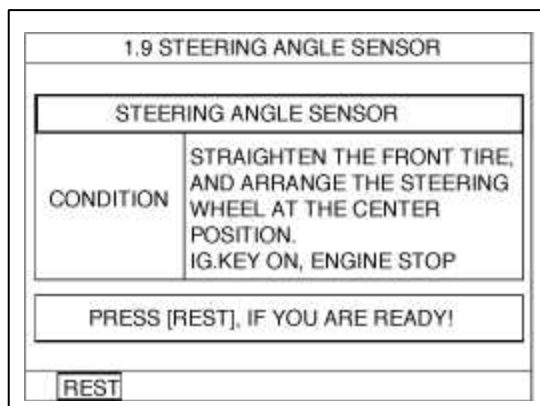
(4) Select Steering angle sensor(SAS) calibration.



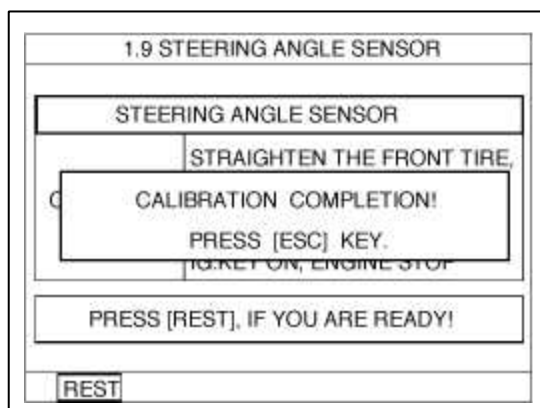
(5) Perform the Steering angle sensor(SAS) calibration.



(6) Perform the procedure continuously.



(7) The procedure is finished. Push the "ESC" key.



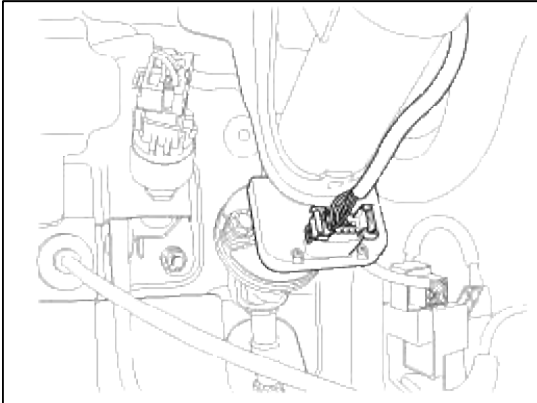
(8) Scanner OFF.

(9) Remove the scanner from the vehicle.

(10) Confirm the Steering angle sensor(SAS) calibration as driving the vehicle.(turn left once, turn right once)

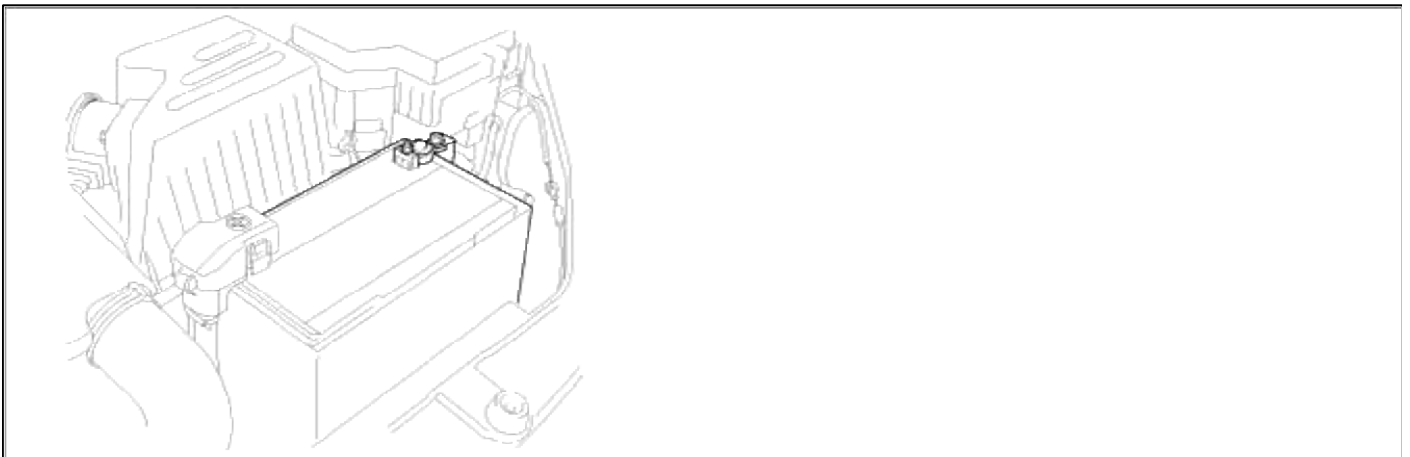
## Brake System > ESP(Electronic Stability Program) System > Steering Angle Sensor > Components and Components Location

### COMPONENT LOCATION



## Brake System > Troubleshooting > C1101

### COMPONENT LOCATION



### General Description

The ABS ECU(Electronic Control Unit) checks the battery voltage to and alternator output voltage determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

### DTC Description

The ABS ECU monitors battery voltage and alternator output voltage by reading the value of voltage. When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/ESC functions are prohibited. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operation as well.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Battery Voltage Monitoring	<ul style="list-style-type: none"> <li>• Poor connection in power supply circuit (IGN+)</li> <li>• Inoperative Alternator</li> </ul>
Monitoring Period	• Continuous (Over voltage faults will be always stored.)	
Enable Conditions	<ul style="list-style-type: none"> <li>• When ign V is higher than 16.8 V.</li> <li>- If the voltage is recovered to 16.7 V, the controller returns to normal state.</li> <li>- The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>• The ABS/EBD/ESC functions are inhibited.</li> <li>- The proper function of valves and return pump is not guaranteed.</li> <li>• The ABS/EBD/ESC warning lamps are activated.</li> <li>• The supply voltage to wheel speed sensor is interrupted.</li> </ul>	

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.

Specification : Approx. Below. 16.7 V

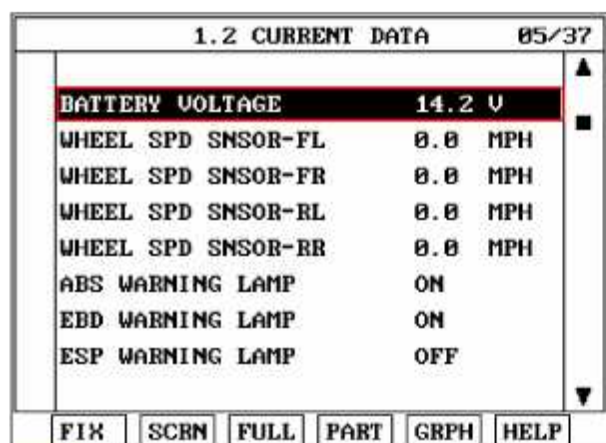


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal Data

4. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in power harness (IGN+) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Confirm the DTC status at another system to be able to confirm C1101 or DTC code related to over voltage.

If there isn't C1101 code at another system, Go to "Power Circuit Inspection" procedure.

If there is C1101 or DTC code related to over voltage at another system, Go to "Alternator Output Voltage Inspection" procedure.

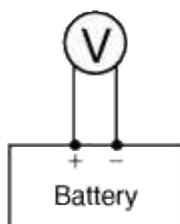
### Alternator Output Voltage Inspection

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and the battery terminal(-) with maintaining ENG RPM 2,500R (idle).over 2 minutes.

---

Specification : Below. 16.7 V

---



1. Battery Terminal(+)
2. Battery Terminal(-)

3. Is the measured voltage within specifications?

**YES**

Go to "Power Circuit Inspection" procedure.

**NO**

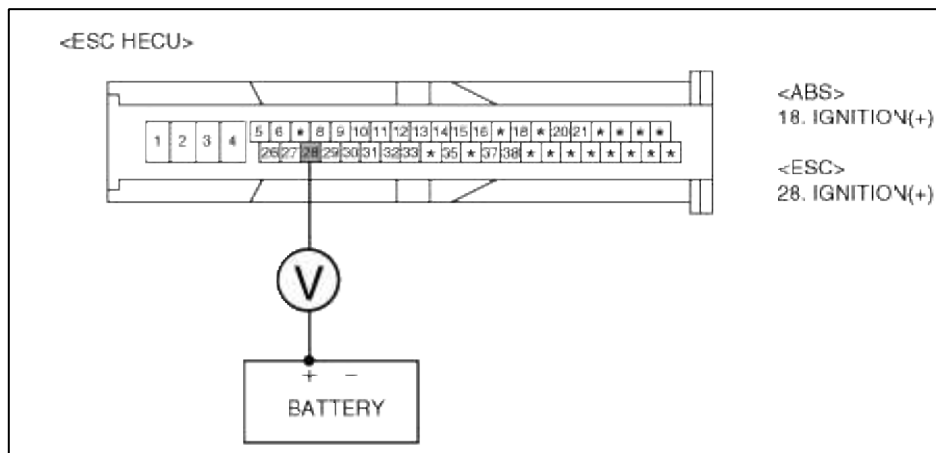
Check that the tension of driving belt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and Check for damaged harness and poor connection between alternator and battery. If OK repair or replace alternator and then go to "Verification Of Vehicle Repair" procedure.

### Power Supply Circuit Inspection

1. Engine "ON".

2. Measure voltage between the battery terminal(+) and terminal "28(ESC), 18(ABS)" of the HECU harness connector.

Specification : Approx. below 0.2 V



3. Is the measured voltage within specifications?

**YES**

Go to "Ground Circuit Inspection" procedure.

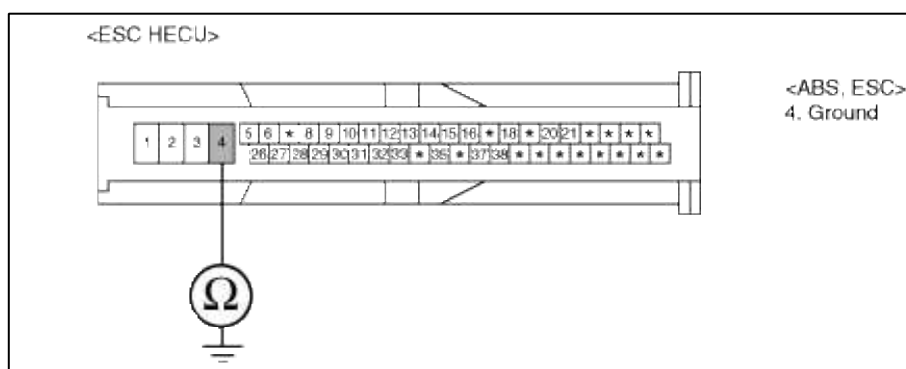
**NO**

Check for damaged harness and poor connection between the battery terminal(+) and terminal "28(ESC), 18(ABS)" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1  $\Omega$



4. Is the measured resistance within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

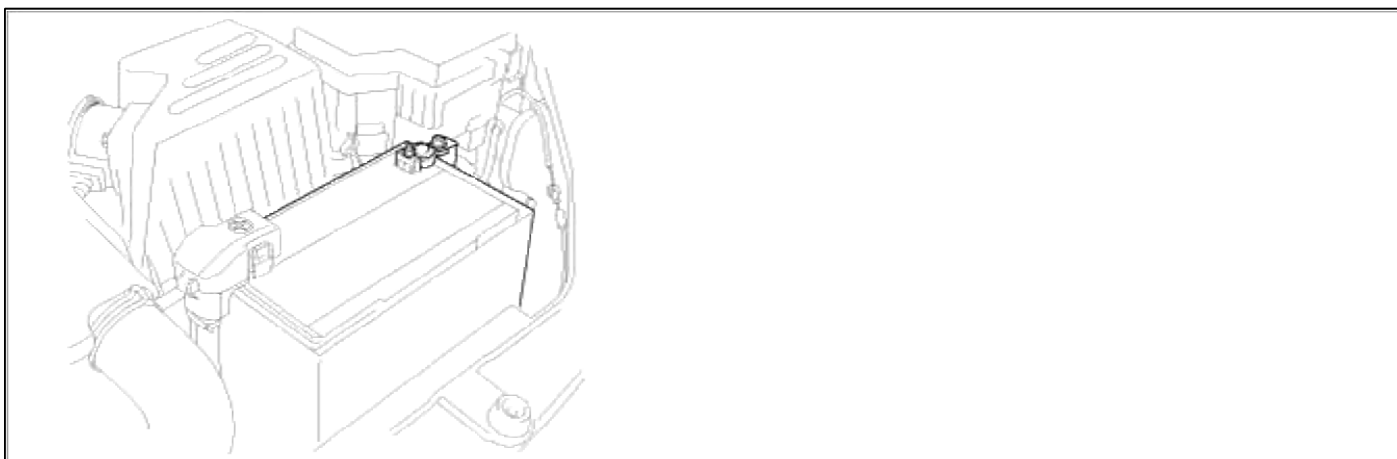
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1102

### COMPONENT LOCATION



### General Description

The ABS ECU(Electronic Control Unit) checks the battery voltage to and alternator output voltage determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

### DTC Description

The ABS ECU monitors the battery voltage and alternator output voltage by reading the value of voltage. When the voltage is lower than the expected normal value, this code is set. The ABS/ESC functions are prohibited and the EBD function is allowed on LOW VOLTAGE CONDITION, the ABS/EBD/ESC functions are prohibited on UNDER VOLTAGE CONDITION. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operations as well.

### DTC Detecting Condition

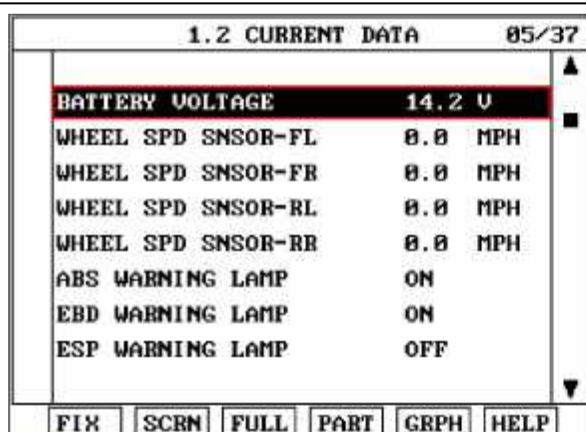


Item		Detecting Condition	Possible cause
DTC Strategy		• Battery Voltage Monitoring	<ul style="list-style-type: none"> <li>• Poor connection in power supply circuit (IGN+)</li> <li>• Inoperative Alternator</li> <li>• Battery discharge</li> </ul>
Monitoring Period		• Continuous	
Case1 (Low voltage)	Enable Conditions	<ul style="list-style-type: none"> <li>• When ign V is lower than 9.3 V outside ABS/ESC control.</li> <li>• When ign V is lower than 9.2V inside ABS/ESC control. <ul style="list-style-type: none"> <li>- If IGN voltage is recovered to 9.6 V, the system recovers to normal state.</li> <li>- The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.</li> </ul> </li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>• The ABS/ESC functions are inhibited.</li> <li>• The ABS/ESC warning lamps are activated.</li> </ul>	
Case2 (Under voltage)	Enable Conditions	<ul style="list-style-type: none"> <li>• When ign V is lower than 7.7V. <ul style="list-style-type: none"> <li>-If IGN voltage is recovered to 7.8V, the system recovers to normal state.</li> <li>- The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.</li> </ul> </li> <li>Under voltage faults are only entered in the EEPROM if the vehicle speed is &gt; 6km/h.</li> <li>If FSA test detect under voltage. this will have entered, because no vehicle speed is available during test.</li> <li>FSA test : fail save circuit test</li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>• The ABS/EBD/ESC functions are inhibited.</li> <li>• The ABS/EBD/ESC warning lamps are activated.</li> </ul>	

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.

Specification : Above. 9.6 V



**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "ON". Normal Data

4. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in power harness (IGN+) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused poor harness(es) and terminals condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Alternator Output Voltage" procedure.

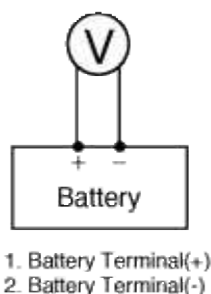
### Alternator Output Voltage Inspection

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and the battery terminal(-) with maintaining ENG RPM 2,500R (idle) over 2 minutes.

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Specification : Above. 9.6 V

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3. Is the measured voltage within specifications?

**YES**

Go to "Power Circuit Inspection" procedure.

**NO**

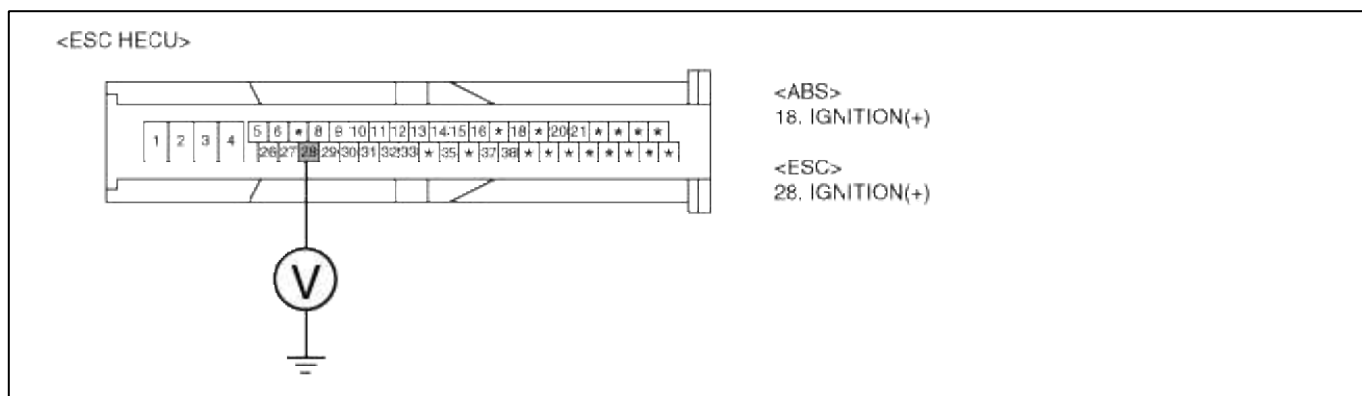
Check that the tension of driving belt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and check for damaged harness and poor connection between alternator and battery. If OK repair or replace alternator and then go to "Verification Of Vehicle Repair" procedure.

### Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal "28(ESC), 18(ABS)" of the HECU harness connector and chassis ground.

Specification : Approx. B+



5. Is the measured voltage within specifications?

**YES**

Go to "Ground Circuit Inspection" procedure.

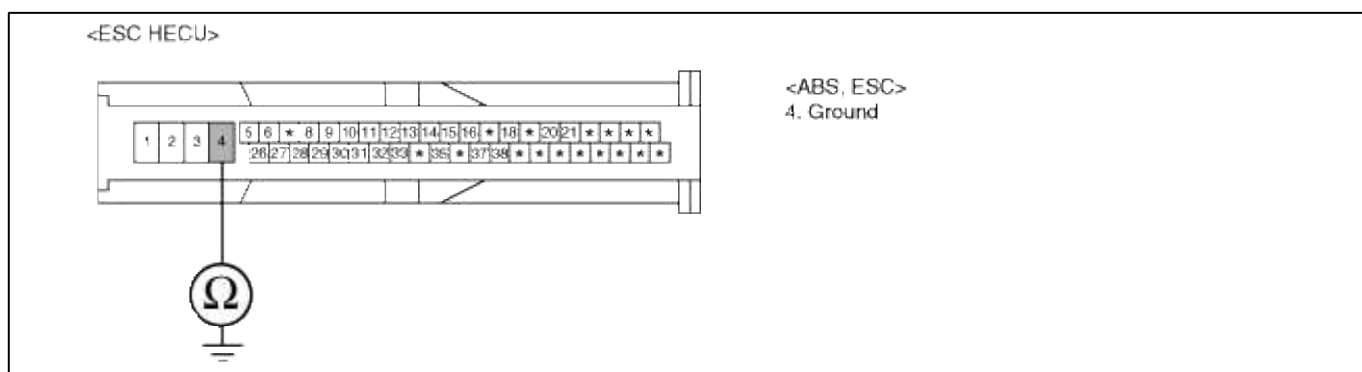
**NO**

Check for damaged harness and poor connection between the battery terminal(+) and terminal "28(ESC), 18(ABS)" of the HECU harness connector. Check for open or blown 10A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1  $\Omega$



4. Is the measured resistance within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.

3. Operate the vehicle within DTC Detecting Condition in General Information

4. Are any DTCs present?

**YES**

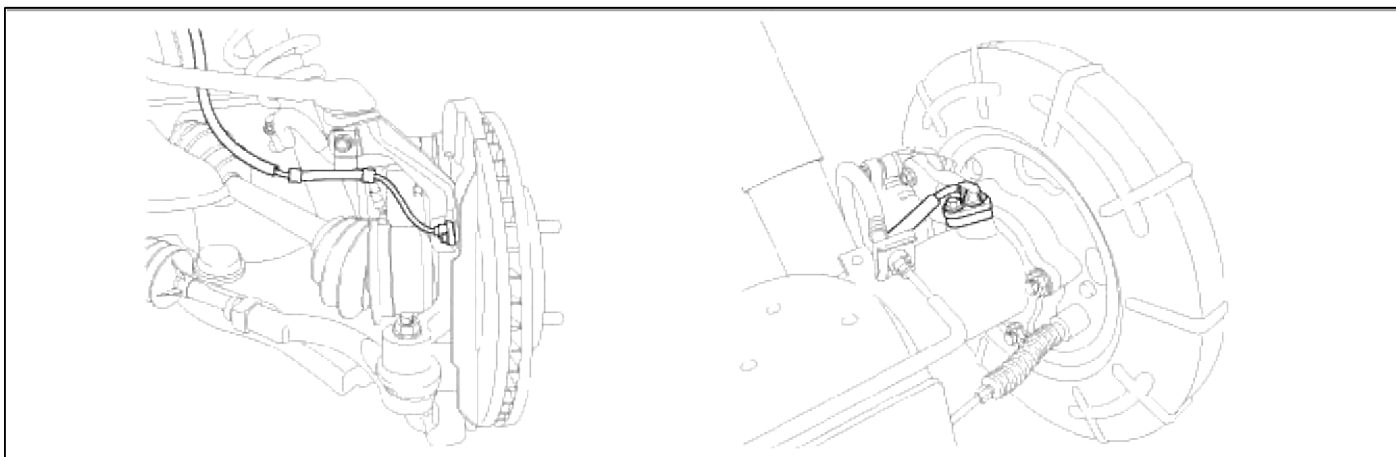
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1200

### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of Wheel speed sensor circuit</li> <li>• Inoperative Wheel speed sensor</li> <li>• Inoperative HECU</li> </ul>
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>• Once after power up.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized. In case of a WSS power line short to V<sub>batt</sub>, this FSA test will detect an under voltage failure. (ABS only)</li> <li>FSA test : fail save circuit test</li> <li>UZ : Ignition Voltage</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• When the sensor current levels are out of permissible range(LOW : 7 mA, HIGH : 14 mA) for 200 ms.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> </ul>	

#### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6.2 mph)

#### 4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

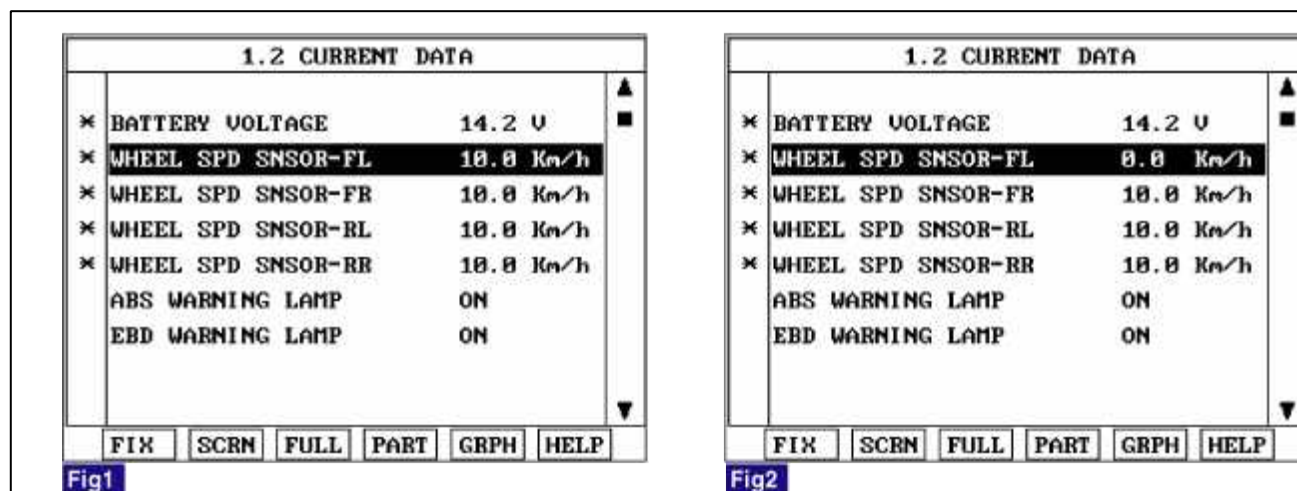


Fig 1) Test Condition : Drive vehicle at a speed of 10km/h or more. (6.2mph or more) Normal D

Fig 2) Test Condition : Drive vehicle at a speed of 10km/h or more. (6.2mph or more) Abnormal Data (Open)

#### 5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

#### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

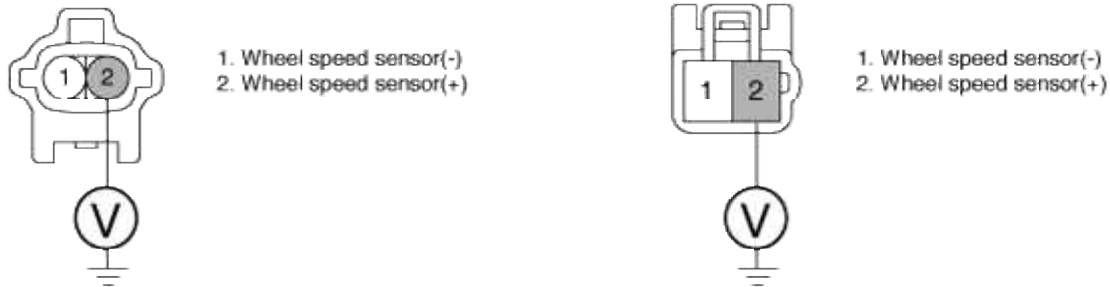
Go to "Power Circuit Inspection" procedure.

#### Power Supply Circuit Inspection

1. Ignition "ON".

2. Measure voltage between terminal (FL, FR : 2, RL, RR : 2) of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



3. Is the measured voltage within specifications?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 2, RL, RR : 2" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

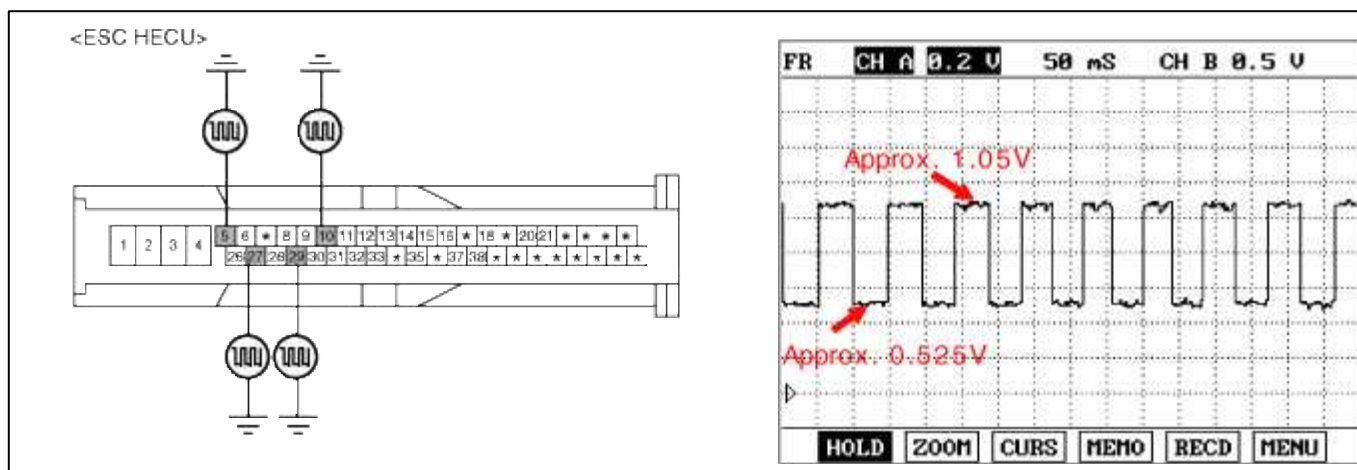
DTC	LOCATION	HECU harness connector (Power supply)	
		ABS	ESC
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

#### Signal Circuit Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

#### 4. Measure waveform between terminal of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESC
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

#### 5. Is the measured waveform within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Go to "Component Inspection" procedure.

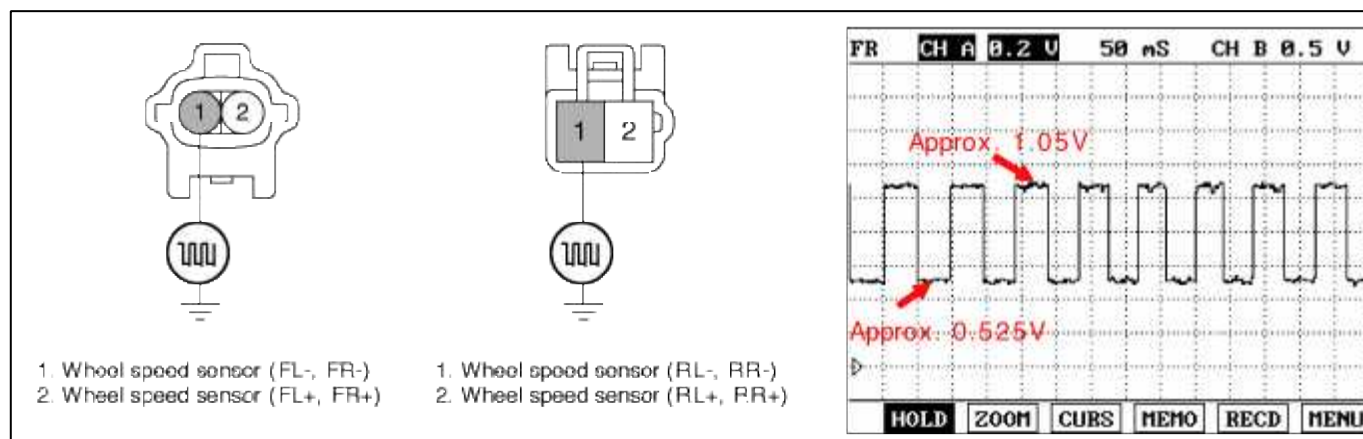
#### Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.



4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

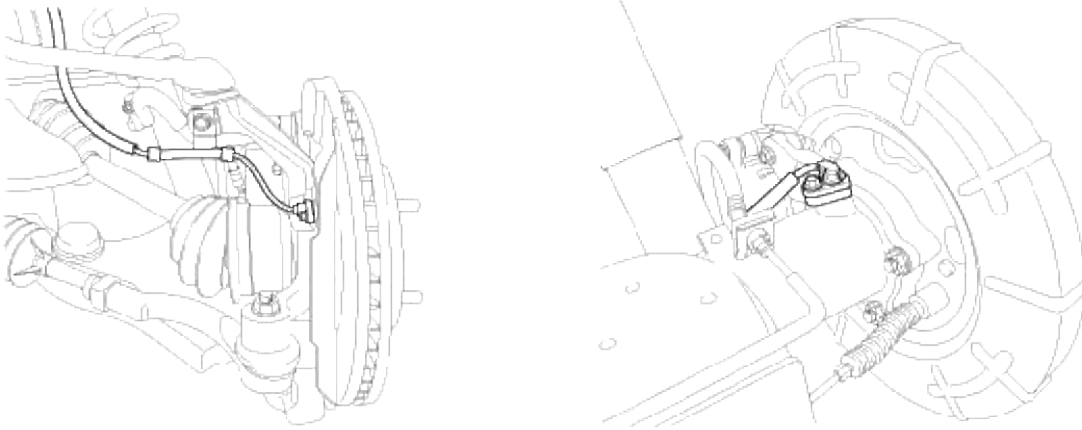
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1201

#### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h (6.2 mph to 49.7 mph). Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h (7.5 mph).

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>The monitoring is active from 10 km/h to 80 km/h (6.2 mph to 49.7 mph) and if no ABS-control is active at a front wheel and a rear wheel.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If following interference and signal disturbance is detected, a failure is set after 10 s. <ul style="list-style-type: none"> <li>non-plausible high frequency received.</li> <li>non-plausible high wheel acceleration.</li> <li>non-plausible high wheel jerk.</li> <li>non-plausible delta T and edges at low speed.</li> </ul> </li> </ul>	

Fail Safe	<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> <li>• External noise</li> </ul>
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#### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h(7.5 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

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Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition

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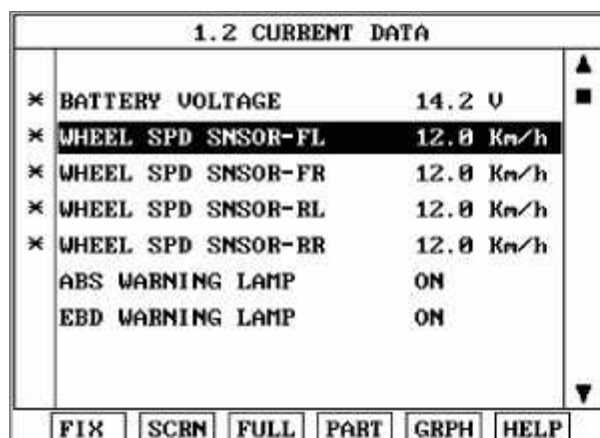


Fig1

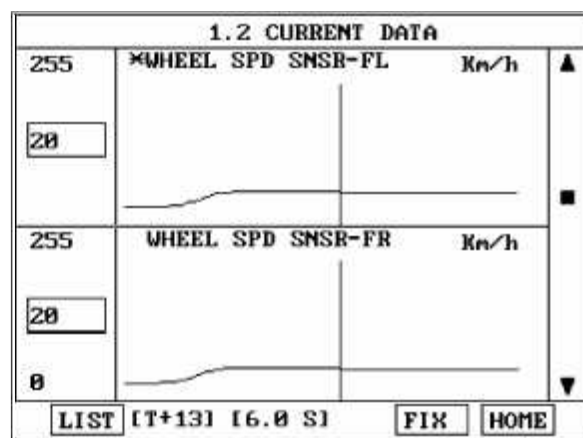


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 12 km/h or more. (7.5mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 20 km/h or more. (12.4mph or more) Normal Graph

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

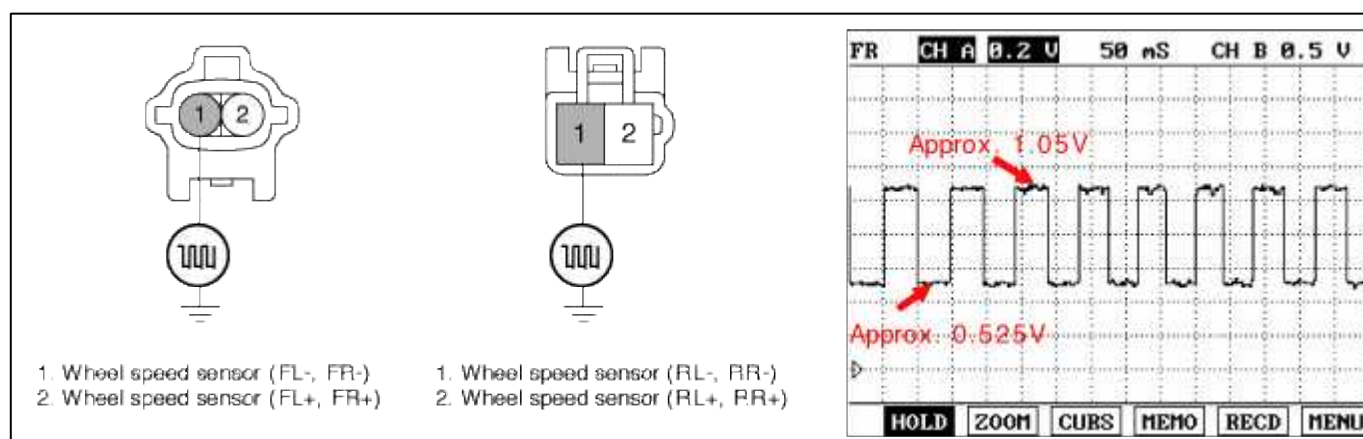
**NO**

Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h (7.5 mph))
4. Are any DTCs present ?

**YES**

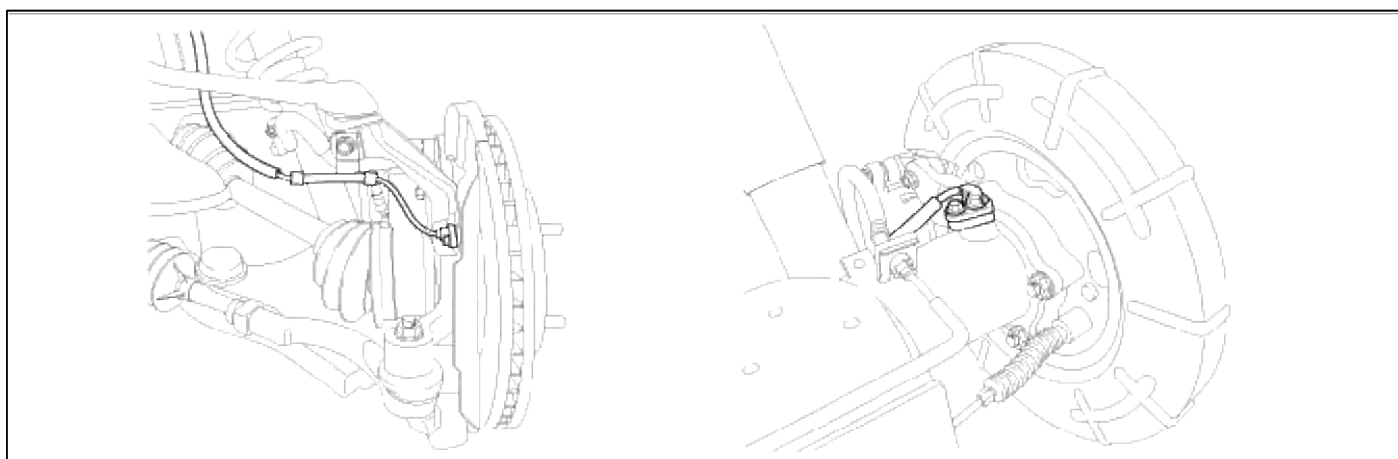
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1202

### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic.

Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26.8 mph) or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h(1.7 mph) while the vehicle speed is at 12 km/h(7.5 mph). Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h(7.5 mph).

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	
Case1	Monitoring Period	• Continuous (only no under voltage is not detected)	
	Enable Conditions	<ul style="list-style-type: none"> <li>• If one (or two) wheel are at 2.75 km/h(1.7 mph) and the other wheels are above 12 km/h(7.5 mph) for longer than 1s.</li> <li>• During driving, when the vehicle accelerates 18 km/h(11.2 mph) after a particular wheel speed gets to 2.75 km/h(1.7 mph) and stays there. At that time, If one (or two) wheel are at 2.75 km/h(1.7 mph). <ul style="list-style-type: none"> <li>- This monitoring is performed at the following condition. <ol style="list-style-type: none"> <li>1. At the time the vehicle is accelerated to 12 km/h(7.5 mph).</li> <li>2. Once after energizing the system.</li> <li>3. If the vehicle was stationary for approx. 2s.</li> </ol> </li> </ul> </li> <li>• If one (or two) wheels are under 5 km/h(3.1 mph) and the two fastest wheels have a velocity above 12 km/h(7.5 mph) for more than 20s.</li> </ul>	
	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous ( If vehicle speed &gt; 12 m/s) <ul style="list-style-type: none"> <li>- but this monitoring is disabled in the following event <ol style="list-style-type: none"> <li>1. Aquaplaning.</li> <li>2. Interference.</li> <li>3. Supply voltage below 7.6 or above 18 Volts</li> </ol> </li> </ul> </li> </ul>	
Case2	Enable Conditions	<ul style="list-style-type: none"> <li>• No wheel speed signals within 10 ms to 20 ms at a vehicle speed &gt; 12 m/s (43.2 km/h(26.8 mph)). <ul style="list-style-type: none"> <li>- If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</li> <li>- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.</li> </ul> </li> </ul>	
	Monitoring Period	• Continuous	

Case3 - ABS Only	Enable Conditions	<ul style="list-style-type: none"> <li>• Vehicle &lt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; 1.7m/s (6km/h(3.7mph)).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; 1.7m/s + 1.1m/s.</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; 1.7m/s + 2.2m/s.</li> </ul> <p>If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted.</p> </li> <li>• Vehicle &gt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; (6%×Vref).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; (6%×Vref + 1.1m/s).</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; (6%×Vref + 2.2m/s).</li> </ul> <p>V_ref : Vehicle Reference Speed</p> </li> <li>• Detection filter time <ul style="list-style-type: none"> <li>- Response and detection filter time depend on the amount of the speed difference and additional conditions as shown below. <ol style="list-style-type: none"> <li>1. 18s - if fault threshold is exceeding &gt; 1.7m/s resp.6%</li> <li>2. 9s - if fault threshold is exceeding &gt; 3.3m/s resp. 12%</li> <li>3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s.</li> <li>4. If spinning wheel is detected the fault detection filter time is not shorter than 72s.</li> </ol> </li> </ul> </li> <li>• Fault allocation <p>If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s. Otherwise a general WSS_Generic faulty (C1213) is set.</p> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>• Main Monitoring <ul style="list-style-type: none"> <li>- The main monitor needs additional information of the ESC-sensors and is active for a velocity &gt; 20 km/h(12.4 mph) and no under voltage is detected.</li> </ul> </li> <li>• Backup Monitoring <ul style="list-style-type: none"> <li>- Continuous</li> </ul> </li> </ul>	
		<ul style="list-style-type: none"> <li>• Main Monitoring</li> </ul>	

Case4 - ESC Only	Enable Conditions	<ol style="list-style-type: none"><li>1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%.</li><li>2. Detection filter time :<ul style="list-style-type: none"><li>- the above conditions apply for 20s for 1 defective wheel speed sensor.</li><li>- the above conditions apply for 40s for 2 defective wheel speed sensor.</li></ul>If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set.</li><li>• Backup Monitoring<ol style="list-style-type: none"><li>1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h(31.1 mph).</li><li>2. When the velocity is below 50 km/h(31.1 mph), if the deviation exceeds an absolute value of 3km/h(1.9 mph).</li><li>3. Detection filter time : normally 20s<ul style="list-style-type: none"><li>- In case of a detected curve, the threshold is increased with an additional value of 4 km/h(2.5 mph).</li></ul></li></ol></li></ol>
Fail Safe		<ul style="list-style-type: none"><li>• Sensor failure outside of the ABS control cycle<ol style="list-style-type: none"><li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li><li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li><li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li></ol></li><li>• Sensor failure inside the ABS control cycle<ol style="list-style-type: none"><li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li><li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li><li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li></ol></li></ul>



2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h(31.1 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

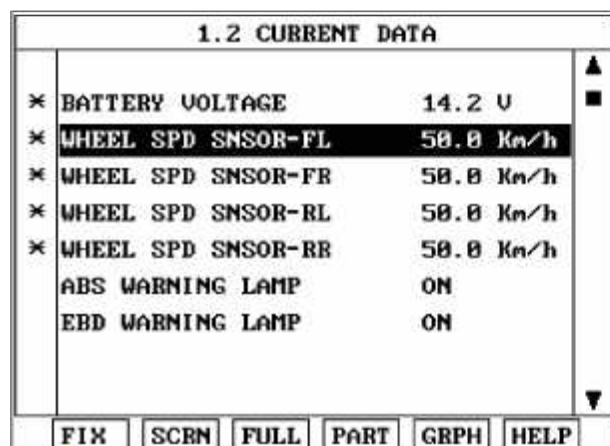


Fig1

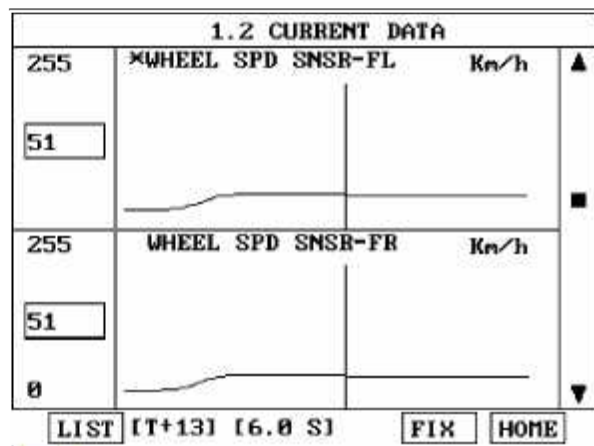


Fig2

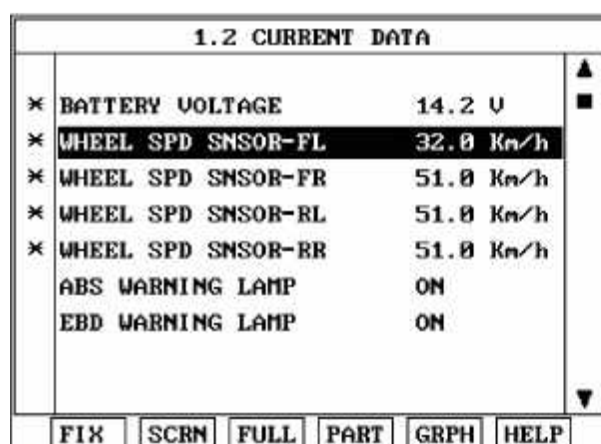


Fig3

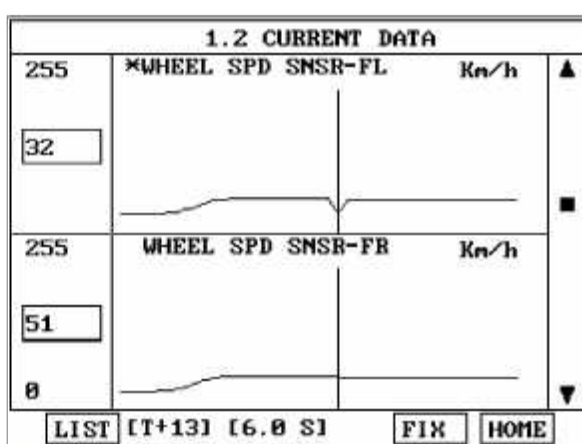


Fig4

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31.1 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Normal Graph

Fig 3) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Data

Fig 4) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Graph

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

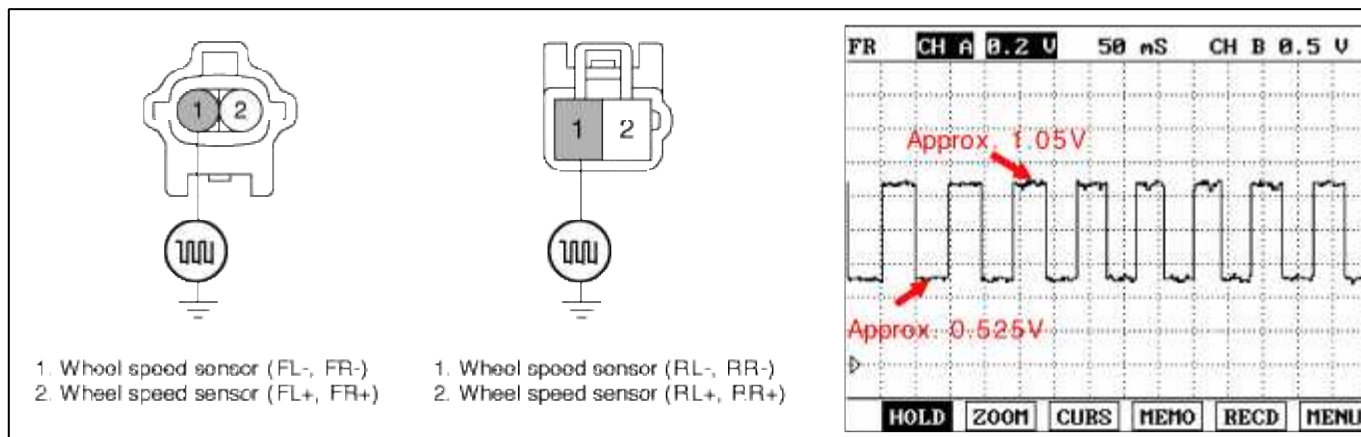
Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

4. Measure waveform between terminal "FL, FR : , RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h (31.1 mph))
4. Are any DTCs present ?

**YES**

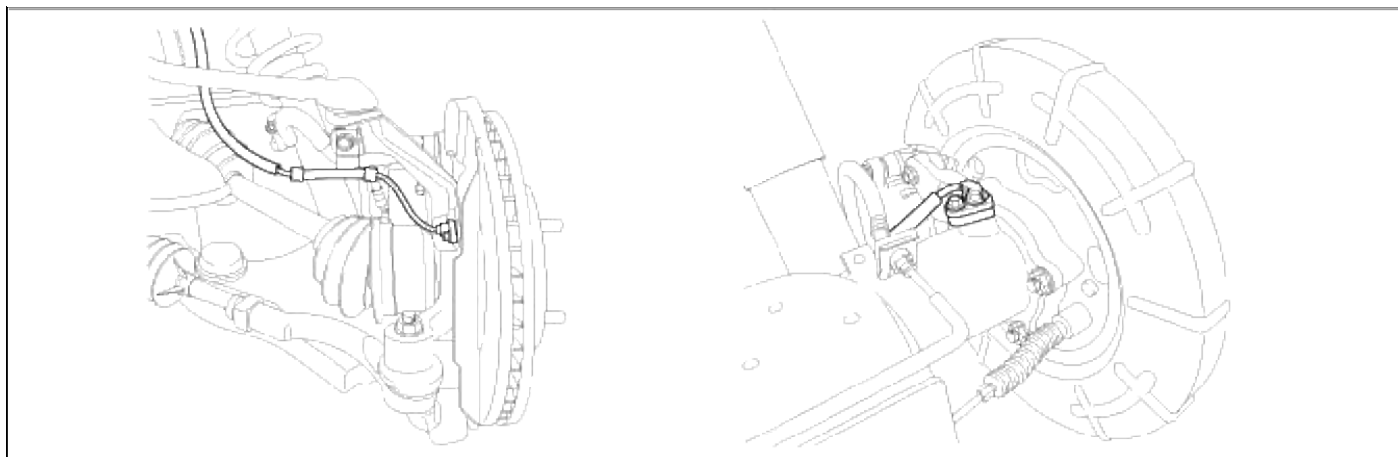
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1203

### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized. In case of a WSS power line short to V<sub>batt</sub>, this FSA test will detect an under voltage failure. (ABS only)</li> <li>FSA test : fail save circuit test</li> <li>UZ : Ignition Voltage</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>When the sensor current levels are out of permissible range(LOW : 7 mA, HIGH : 14 mA) for 200 ms.</li> </ul>	
		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle</li> </ul>	

Fail Safe	<ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> <ul style="list-style-type: none"> <li>• Sensor failure inside the ABS control cycle <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of Wheel speed sensor circuit</li> <li>• Inoperative Wheel speed sensor</li> <li>• Inoperative HECU</li> </ul>
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#### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6.2 mph)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

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Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

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1.2 CURRENT DATA		
※ BATTERY VOLTAGE	14.2 V	
※ WHEEL SPD SENSOR-FL	10.0 Km/h	
※ WHEEL SPD SENSOR-FR	10.0 Km/h	
※ WHEEL SPD SENSOR-RL	10.0 Km/h	
※ WHEEL SPD SENSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
<div> <div>FIX</div> <div>SCRM</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig1

1.2 CURRENT DATA		
※ BATTERY VOLTAGE	14.2 V	
※ WHEEL SPD SENSOR-FL	0.0 Km/h	
※ WHEEL SPD SENSOR-FR	10.0 Km/h	
※ WHEEL SPD SENSOR-RL	10.0 Km/h	
※ WHEEL SPD SENSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
<div> <div>FIX</div> <div>SCRM</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 10km/h or more. (6.2mph or more) Normal D

Fig 2) Test Condition : Drive vehicle at a speed of 10km/h or more. (6.2mph or more) Abnormal Data (Open)

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

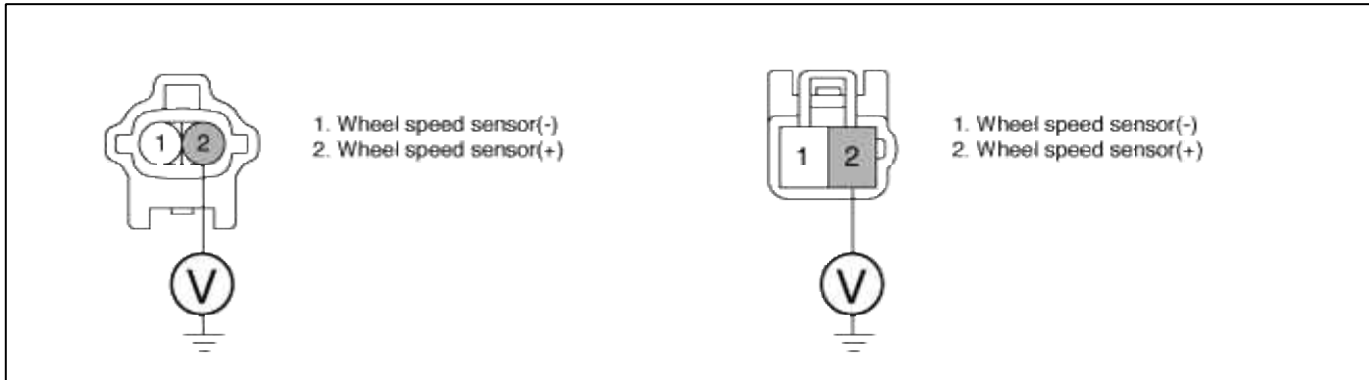
Go to "Power Circuit Inspection" procedure.

### Power Supply Circuit Inspection

1. Ignition "ON".

2. Measure voltage between terminal (FL, FR : 2, RL, RR : 2) of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



3. Is the measured voltage within specifications?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 2, RL, RR : 2" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

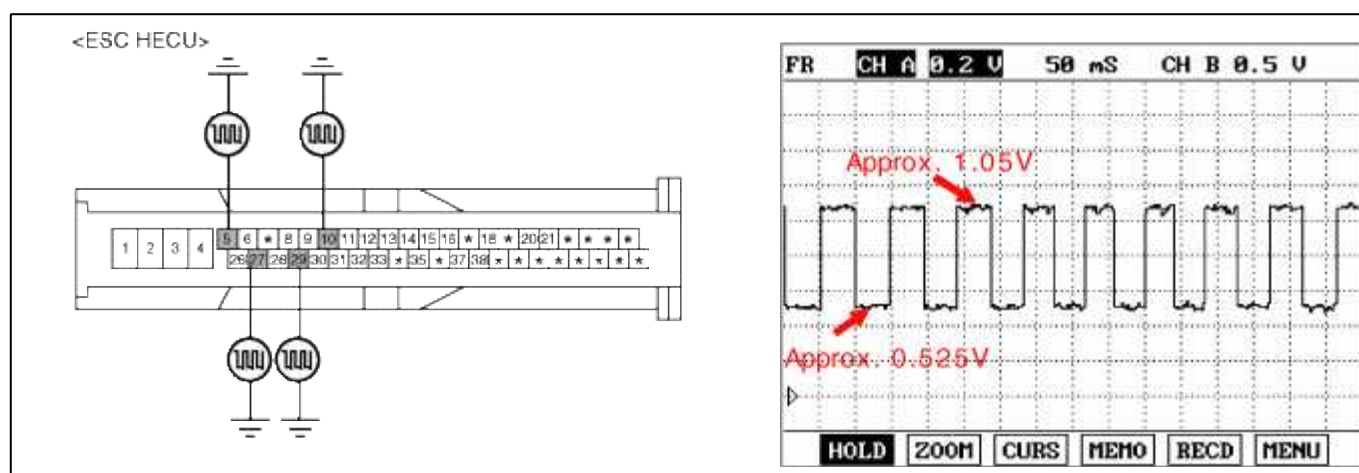
DTC	LOCATION	HECU harness connector (Power supply)	
		ABS	ESC
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

#### Signal Circuit Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

## 4. Measure waveform between terminal of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESC
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

## 5. Is the measured waveform within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Go to "Component Inspection" procedure.

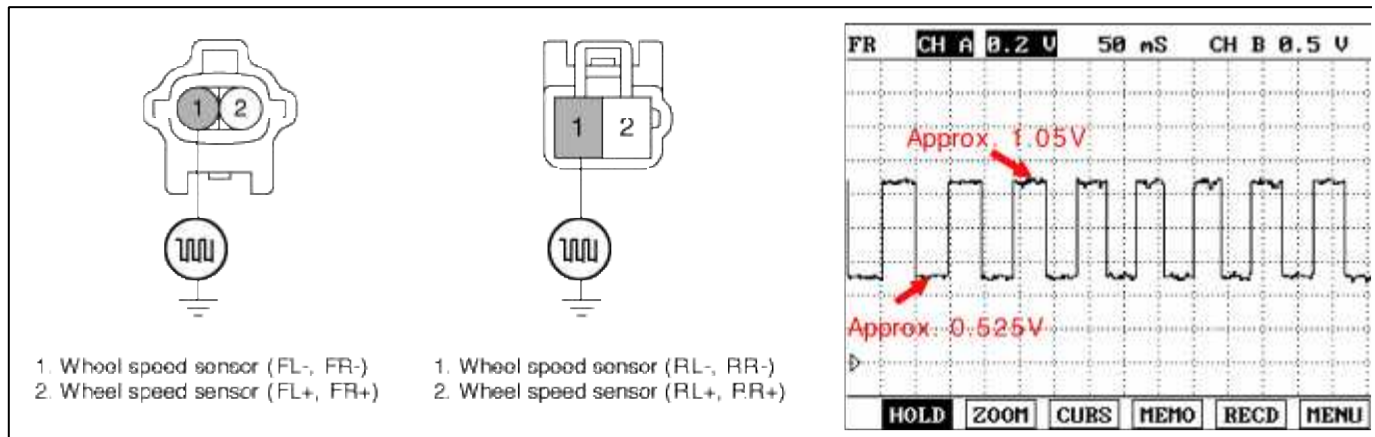
## Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.



4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

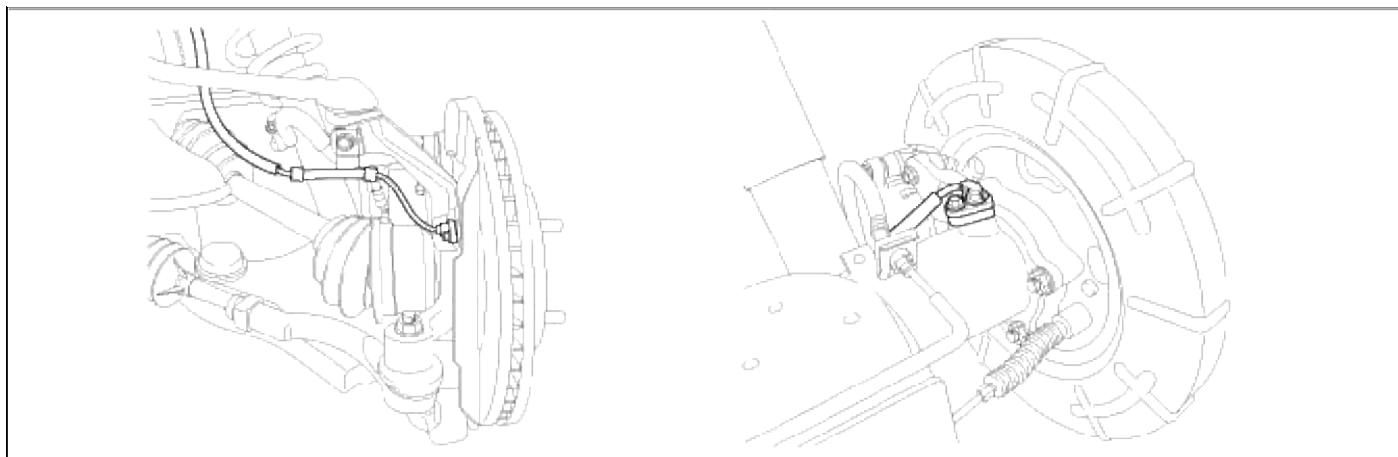
**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1204

### COMPONENT LOCATION





### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h(6.2 mph to 49.7 mph). Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h(7.5 mph).

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>The monitoring is active from 10 km/h to 80 km/h(6.2 mph to 49.7 mph) and if no ABS-control is active at a front wheel and a rear wheel.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If following interference and signal disturbance is detected, a failure is set after 10 s.</li> <li>non-plausible high frequency received.</li> <li>non-plausible high wheel acceleration.</li> <li>non-plausible high wheel jurk.</li> <li>non-plausible delta T and edges at low speed.</li> </ul>	

Fail Safe	<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> <li>• External noise</li> </ul>
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#### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h(7.5 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

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Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition

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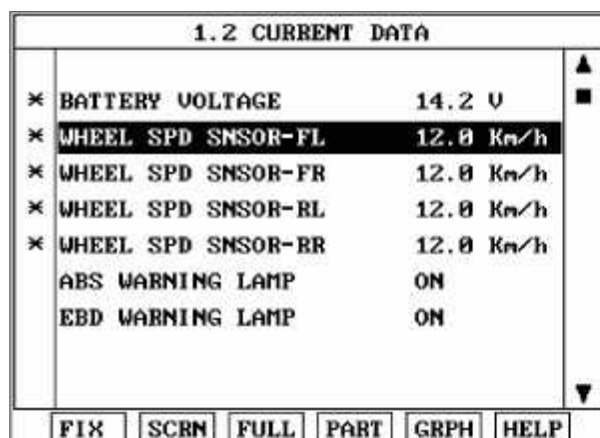


Fig1

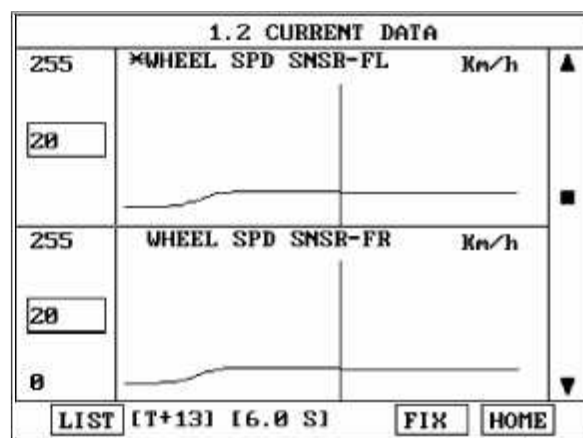


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 12 km/h or more. (7.5mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 20 km/h or more. (12.4mph or more) Normal Graph

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

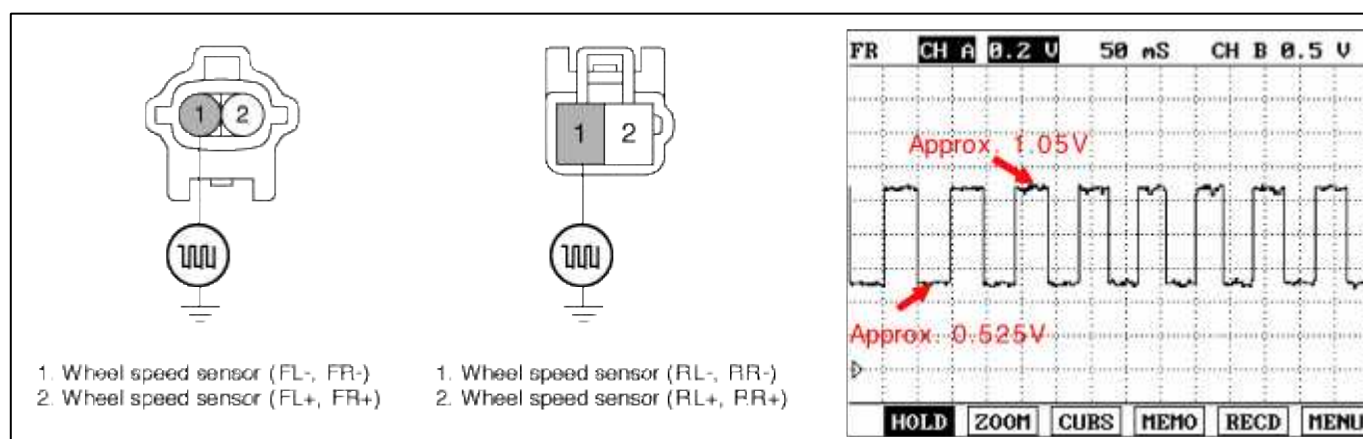
**NO**

Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h (7.5 mph))
4. Are any DTCs present ?

**YES**

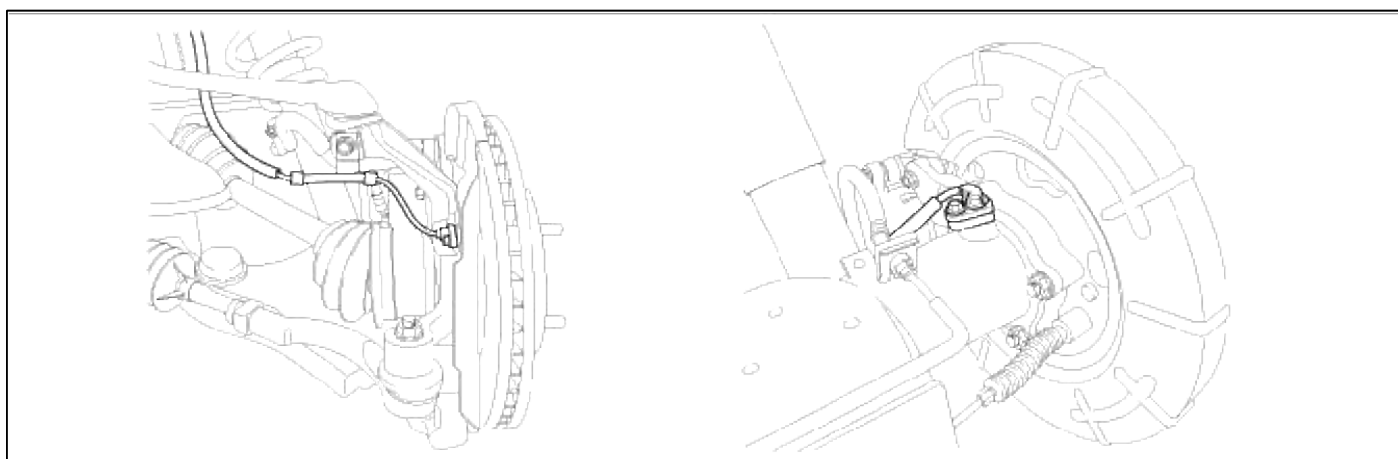
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1205

### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic.

Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26.8 mph) or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h(1.7 mph) while the vehicle speed is at 12 km/h(7.5 mph). Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h(7.5 mph).

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only no under voltage is not detected)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If one (or two) wheel are at 2.75 km/h(1.7 mph) and the other wheels are above 12 km/h(7.5 mph) for longer than 1s.</li> <li>During driving, when the vehicle accelerates 18 km/h(11.2 mph) after a particular wheel speed gets to 2.75 km/h(1.7 mph) and stays there. At that time, If one (or two) wheel are at 2.75 km/h(1.7 mph).               <ul style="list-style-type: none"> <li>- This monitoring is performed at the following condition.                   <ol style="list-style-type: none"> <li>At the time the vehicle is accelerated to 12 km/h(7.5 mph).</li> <li>Once after energizing the system.</li> <li>If the vehicle was stationary for approx. 2s.</li> </ol> </li> </ul> </li> <li>If one (or two) wheels are under 5 km/h(3.1 mph) and the two fastest wheels have a velocity above 12 km/h(7.5 mph) for more than 20s.</li> </ul>	
	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous ( If vehicle speed &gt; 12 m/s)               <ul style="list-style-type: none"> <li>- but this monitoring is disabled in the following event                   <ol style="list-style-type: none"> <li>Aquaplaning.</li> <li>Interference.</li> <li>Supply voltage below 7.6 or above 18 Volts</li> </ol> </li> </ul> </li> </ul>	
Case2	Enable Conditions	<ul style="list-style-type: none"> <li>No wheel speed signals within 10 ms to 20 ms at a vehicle speed &gt; 12 m/s (43.2 km/h(26.8 mph)).               <ul style="list-style-type: none"> <li>- If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</li> <li>- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.</li> </ul> </li> </ul>	
	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	

Case3 - ABS Only	Enable Conditions	<ul style="list-style-type: none"> <li>• Vehicle &lt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; 1.7m/s (6km/h(3.7mph)).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; 1.7m/s + 1.1m/s.</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; 1.7m/s + 2.2m/s.</li> </ul> <p>If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted.</p> </li> <li>• Vehicle &gt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; (6%×Vref).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; (6%×Vref + 1.1m/s).</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; (6%×Vref + 2.2m/s).</li> </ul> <p>V_ref : Vehicle Reference Speed</p> </li> <li>• Detection filter time <ul style="list-style-type: none"> <li>- Response and detection filter time depend on the amount of the speed difference and additional conditions as shown below. <ol style="list-style-type: none"> <li>1. 18s - if fault threshold is exceeding &gt; 1.7m/s resp. 6%</li> <li>2. 9s - if fault threshold is exceeding &gt; 3.3m/s resp. 12%</li> <li>3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s.</li> <li>4. If spinning wheel is detected the fault detection filter time is not shorter than 72s.</li> </ol> </li> </ul> </li> <li>• Fault allocation <p>If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s. Otherwise a general WSS_Generic faulty (C1213) is set.</p> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>• Main Monitoring <ul style="list-style-type: none"> <li>- The main monitor needs additional information of the ESC-sensors and is active for a velocity &gt; 20 km/h(12.4 mph) and no under voltage is detected.</li> </ul> </li> <li>• Backup Monitoring <ul style="list-style-type: none"> <li>- Continuous</li> </ul> </li> </ul>	
		<ul style="list-style-type: none"> <li>• Main Monitoring</li> </ul>	

Case4 - ESC Only	Enable Conditions	<ol style="list-style-type: none"><li>1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%.</li><li>2. Detection filter time :<ul style="list-style-type: none"><li>- the above conditions apply for 20s for 1 defective wheel speed sensor.</li><li>- the above conditions apply for 40s for 2 defective wheel speed sensor.</li></ul>If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set.</li></ol> <ul style="list-style-type: none"><li>• Backup Monitoring<ol style="list-style-type: none"><li>1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h(31.1 mph).</li><li>2. When the velocity is below 50 km/h(31.1 mph), if the deviation exceeds an absolute value of 3km/h(1.9 mph).</li><li>3. Detection filter time : normally 20s<ul style="list-style-type: none"><li>- In case of a detected curve, the threshold is increased with an additional value of 4 km/h(2.5 mph).</li></ul></li></ol></li></ul>
Fail Safe		<ul style="list-style-type: none"><li>• Sensor failure outside of the ABS control cycle<ol style="list-style-type: none"><li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li><li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li><li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li></ol></li><li>• Sensor failure inside the ABS control cycle<ol style="list-style-type: none"><li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li><li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li><li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li></ol></li></ul>

## Monitor Scantool Data

## 1. Engine "ON".

2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h(31.1 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

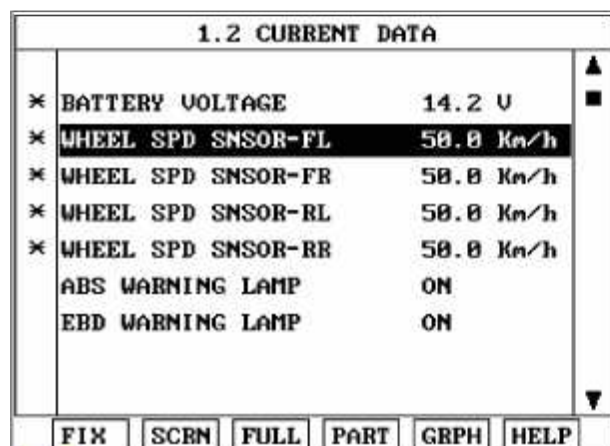


Fig1

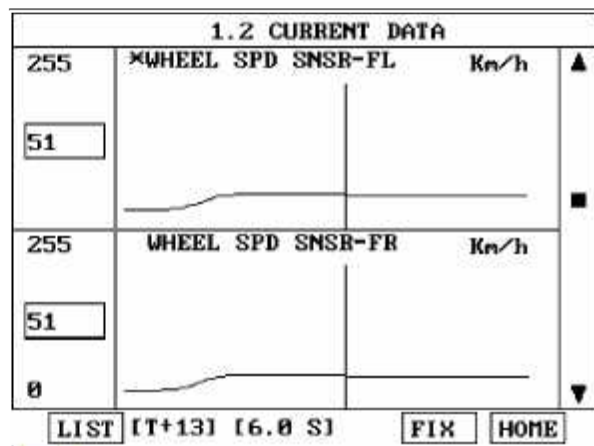


Fig2

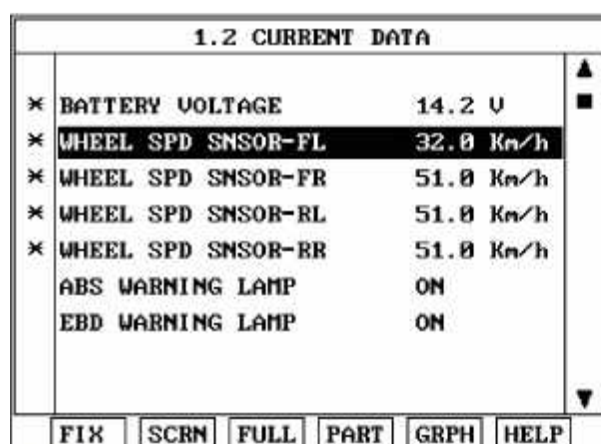


Fig3

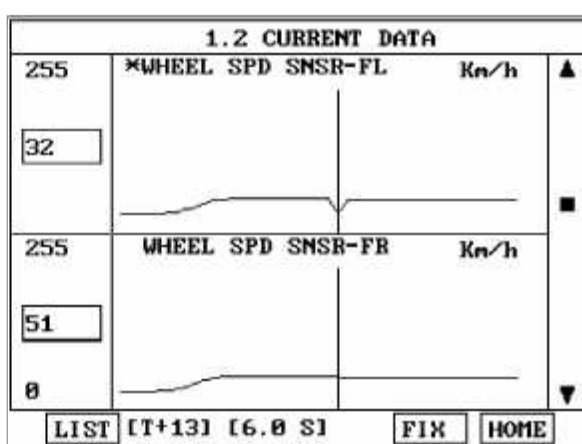


Fig4

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31.1 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Normal Graph

Fig 3) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Data

Fig 4) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Graph

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" Procedure.

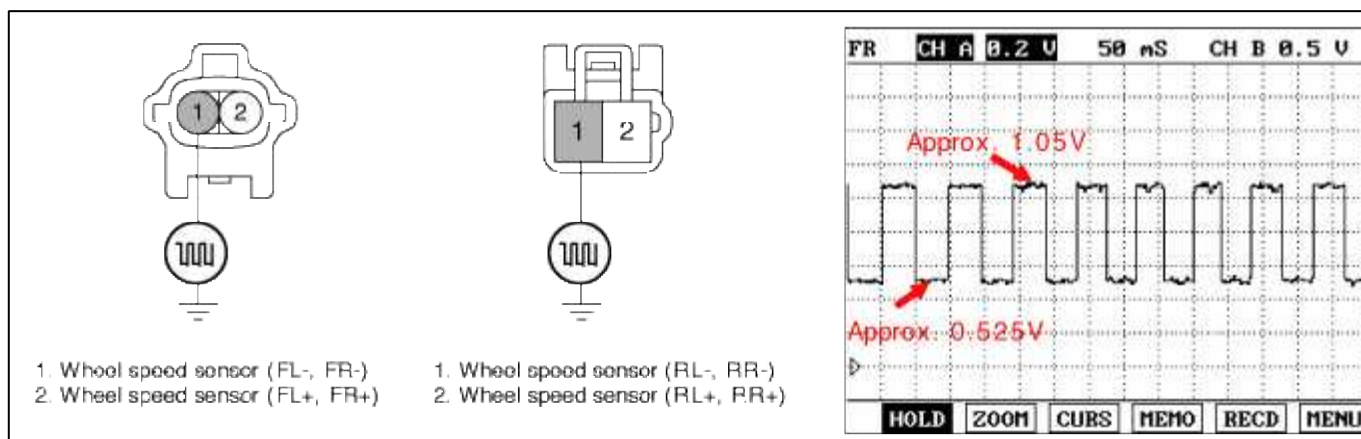
## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.



4. Measure waveform between terminal "FL, FR : , RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h (31.1 mph))
4. Are any DTCs present ?

**YES**

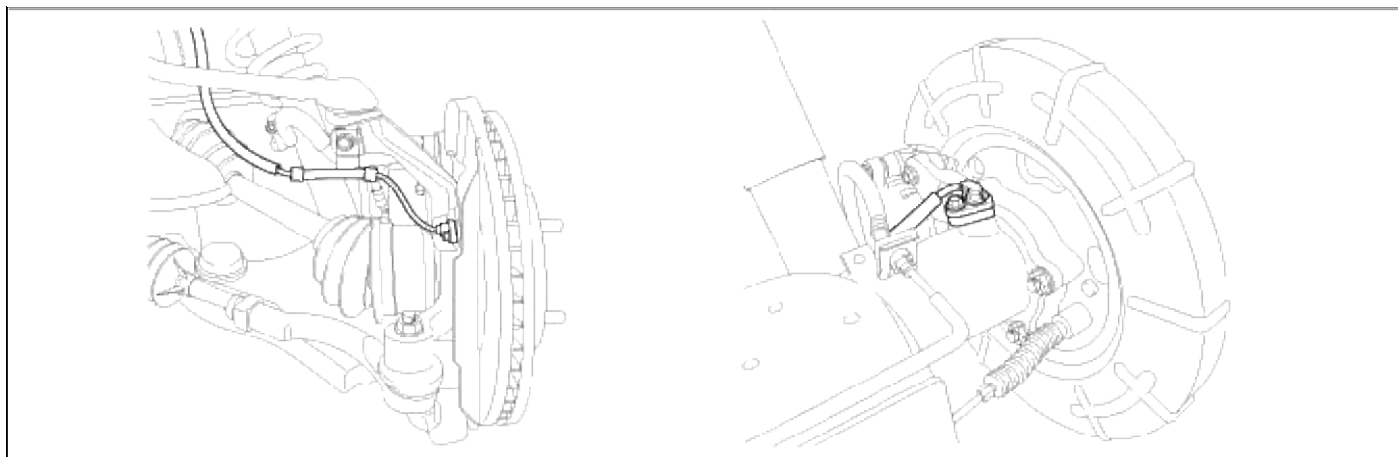
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1206

#### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized. In case of a WSS power line short to V<sub>batt</sub>, this FSA test will detect an under voltage failure. (ABS only)</li> <li>FSA test : fail save circuit test</li> <li>UZ : Ignition Voltage</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>When the sensor current levels are out of permissible range (LOW : 7 mA, HIGH : 14 mA) for 200 ms.</li> </ul>	
		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle</li> </ul>	

Fail Safe	<ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> <ul style="list-style-type: none"> <li>• Sensor failure inside the ABS control cycle <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of Wheel speed sensor circuit</li> <li>• Inoperative Wheel speed sensor</li> <li>• Inoperative HECU</li> </ul>
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#### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6.2 mph)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

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Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

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1.2 CURRENT DATA		
✖ BATTERY VOLTAGE	14.2 V	▲
✖ WHEEL SPD SENSOR-FL	10.0 Km/h	■
✖ WHEEL SPD SENSOR-FR	10.0 Km/h	
✖ WHEEL SPD SENSOR-RL	10.0 Km/h	
✖ WHEEL SPD SENSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig1

1.2 CURRENT DATA		
✖ BATTERY VOLTAGE	14.2 V	▲
✖ WHEEL SPD SENSOR-FL	0.0 Km/h	■
✖ WHEEL SPD SENSOR-FR	10.0 Km/h	
✖ WHEEL SPD SENSOR-RL	10.0 Km/h	
✖ WHEEL SPD SENSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 10km/h or more. (6.2mph or more) Normal D

Fig 2) Test Condition : Drive vehicle at a speed of 10km/h or more. (6.2mph or more) Abnormal Data (Open)

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

- Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

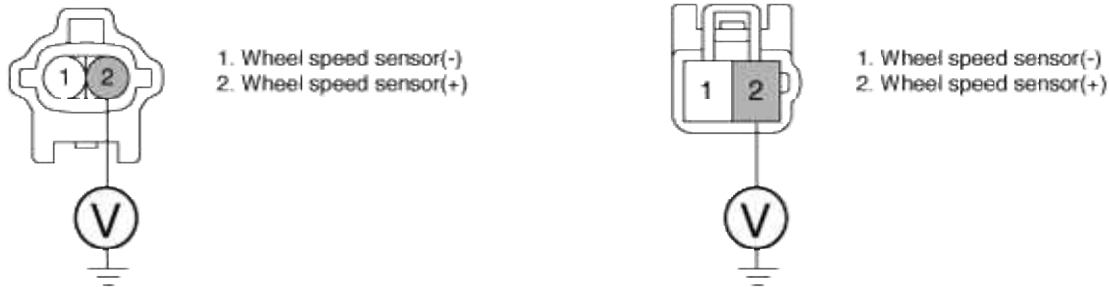
Go to "Power Circuit Inspection" procedure.

### Power Supply Circuit Inspection

- Ignition "ON".

2. Measure voltage between terminal (FL, FR : 2, RL, RR : 2) of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



3. Is the measured voltage within specifications?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 2, RL, RR : 2" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

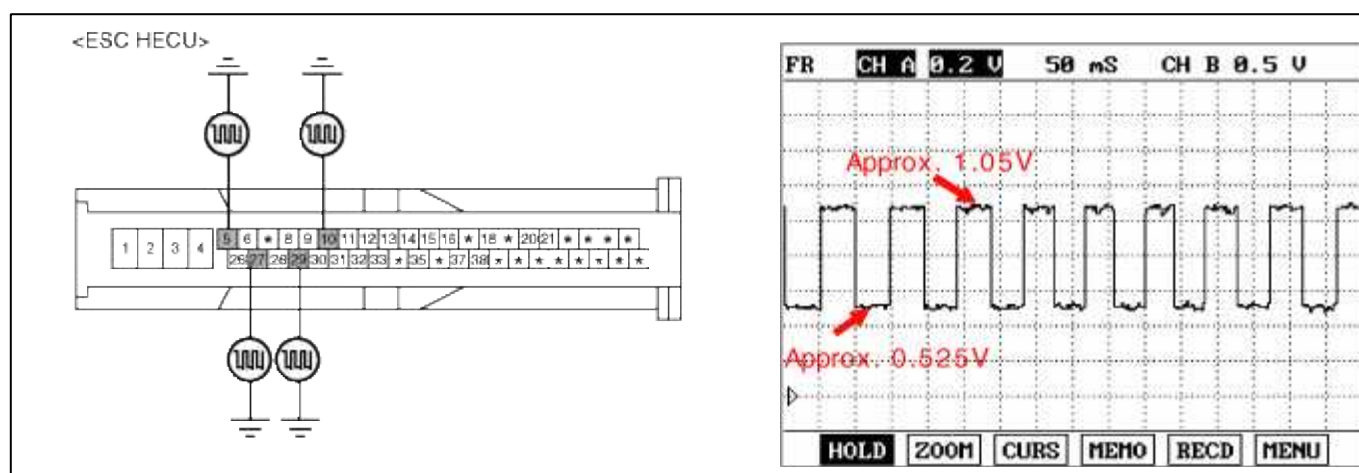
DTC	LOCATION	HECU harness connector (Power supply)	
		ABS	ESC
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

#### Signal Circuit Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

## 4. Measure waveform between terminal of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESC
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

## 5. Is the measured waveform within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

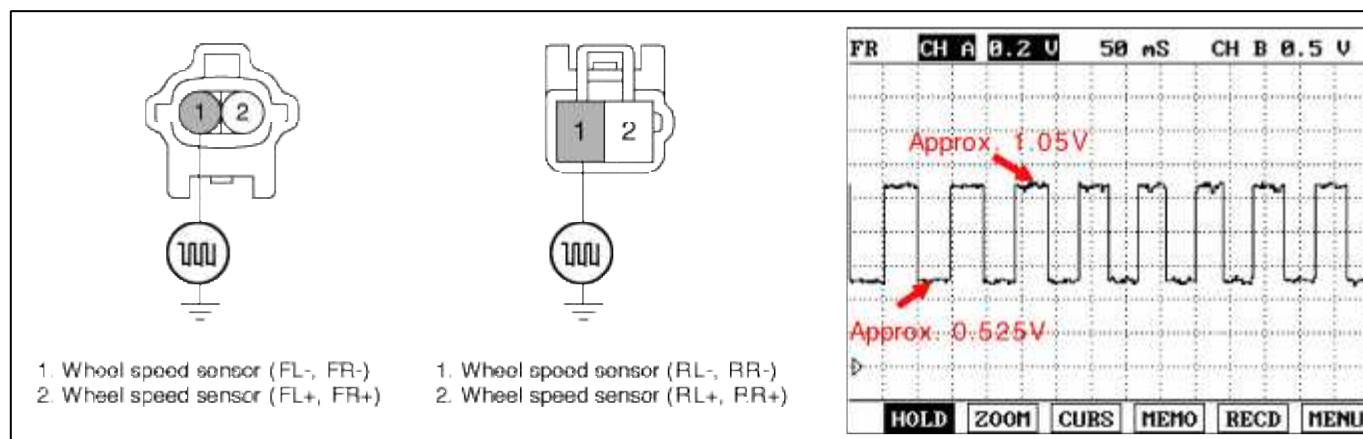
If OK, Go to "Component Inspection" procedure.

## Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

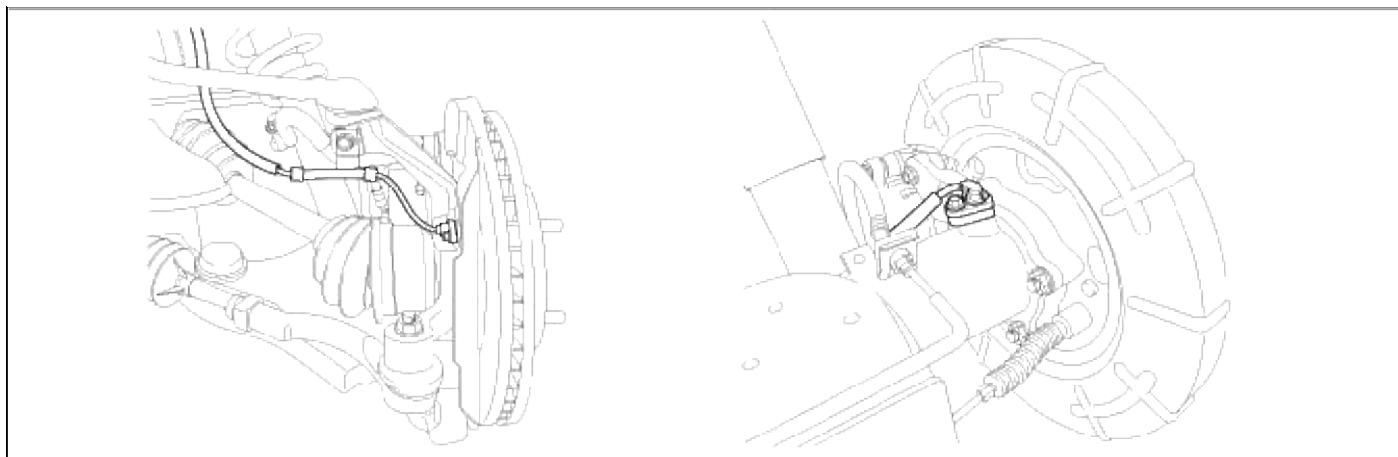
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1207

#### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h(6.2 mph to 49.7 mph). Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h(7.5 mph).

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>The monitoring is active from 10 km/h to 80 km/h(6.2 mph to 49.7 mph) and if no ABS-control is active at a front wheel and a rear wheel.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If following interference and signal disturbance is detected, a failure is set after 10 s.</li> <li>non-plausible high frequency received.</li> <li>non-plausible high wheel acceleration.</li> <li>non-plausible high wheel jerk.</li> <li>non-plausible delta T and edges at low speed.</li> </ul>	



Fail Safe	<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> <li>• External noise</li> </ul>
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#### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h(7.5 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

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Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition

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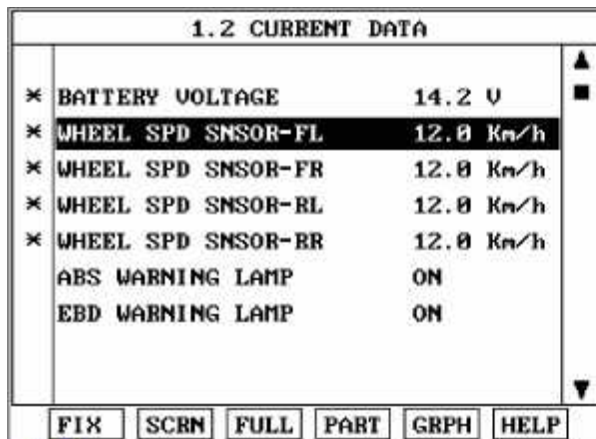


Fig1

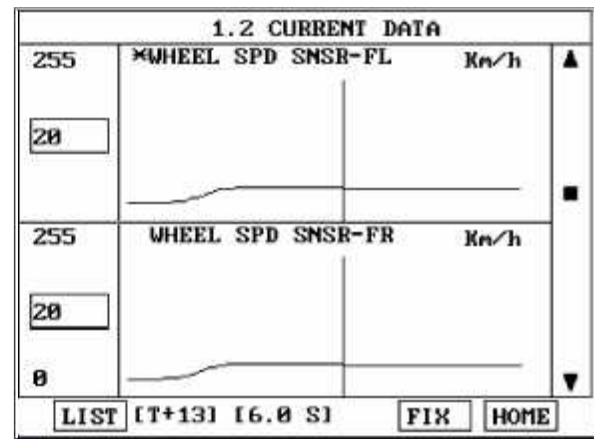


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 12 km/h or more. (7.5mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 20 km/h or more. (12.4mph or more) Normal Graph

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

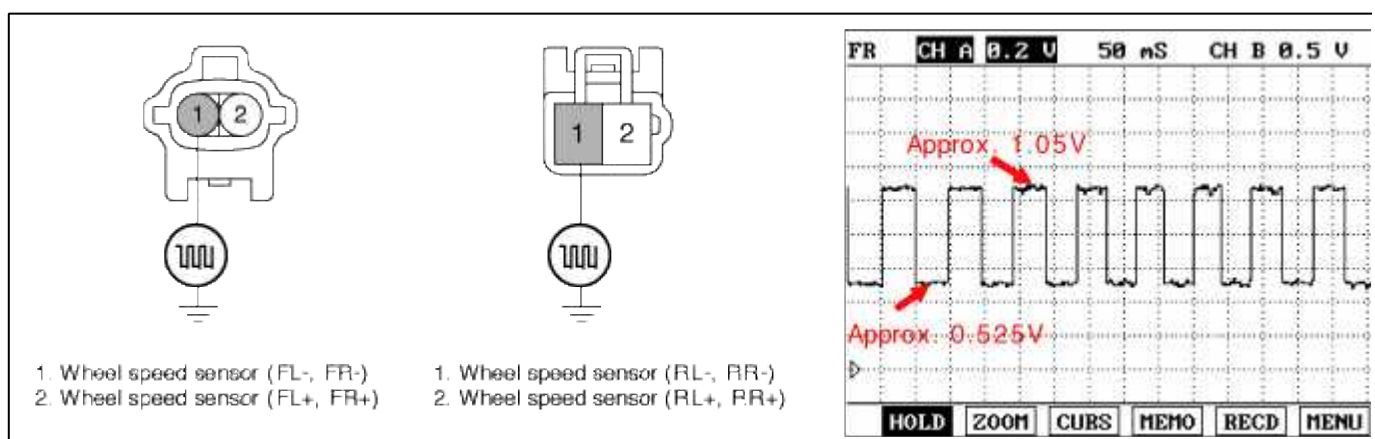
**NO**

Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h (7.5 mph))
4. Are any DTCs present ?

**YES**

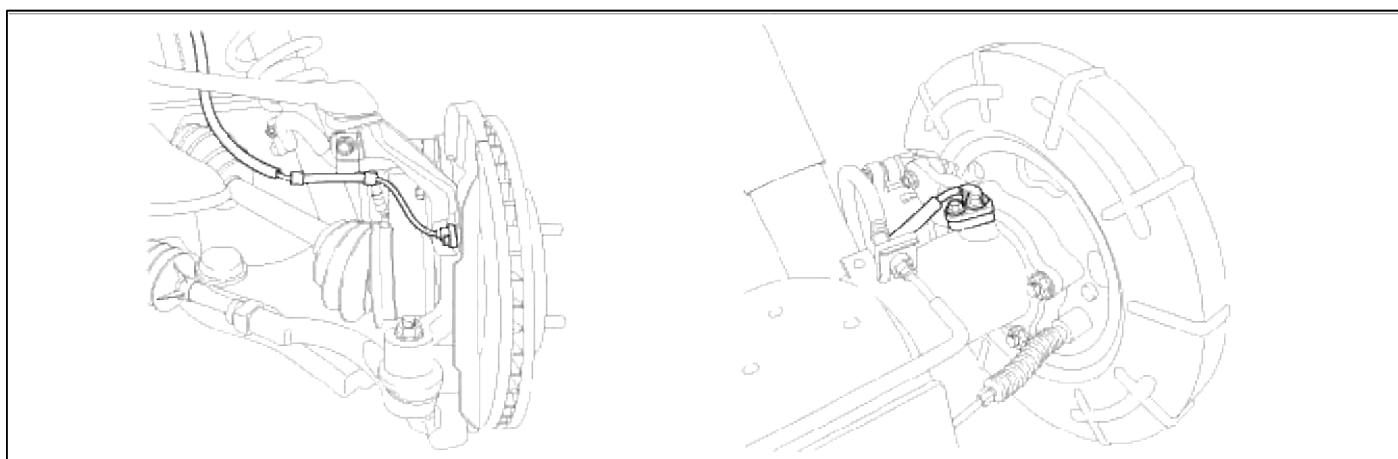
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1208

### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic.

Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26.8 mph) or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h(1.7 mph) while the vehicle speed is at 12 km/h(7.5 mph). Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h(7.5 mph).

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	
Case1	Monitoring Period	• Continuous (only no under voltage is not detected)	
	Enable Conditions	<ul style="list-style-type: none"> <li>• If one (or two) wheel are at 2.75 km/h(1.7 mph) and the other wheels are above 12 km/h(7.5 mph) for longer than 1s.</li> <li>• During driving, when the vehicle accelerates 18 km/h(11.2 mph) after a particular wheel speed gets to 2.75 km/h(1.7 mph) and stays there. At that time, If one (or two) wheel are at 2.75 km/h(1.7 mph). <ul style="list-style-type: none"> <li>- This monitoring is performed at the following condition. <ol style="list-style-type: none"> <li>1. At the time the vehicle is accelerated to 12 km/h(7.5 mph).</li> <li>2. Once after energizing the system.</li> <li>3. If the vehicle was stationary for approx. 2s.</li> </ol> </li> </ul> </li> <li>• If one (or two) wheels are under 5 km/h(3.1 mph) and the two fastest wheels have a velocity above 12 km/h(7.5 mph) for more than 20s.</li> </ul>	
	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous ( If vehicle speed &gt; 12 m/s) <ul style="list-style-type: none"> <li>- but this monitoring is disabled in the following event <ol style="list-style-type: none"> <li>1. Aquaplaning.</li> <li>2. Interference.</li> <li>3. Supply voltage below 7.6 or above 18 Volts</li> </ol> </li> </ul> </li> </ul>	
Case2	Enable Conditions	<ul style="list-style-type: none"> <li>• No wheel speed signals within 10 ms to 20 ms at a vehicle speed &gt; 12 m/s (43.2 km/h(26.8 mph)). <ul style="list-style-type: none"> <li>- If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</li> <li>- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.</li> </ul> </li> </ul>	
	Monitoring Period	• Continuous	

Case3 - ABS Only	Enable Conditions	<ul style="list-style-type: none"> <li>• Vehicle &lt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; 1.7m/s (6km/h(3.7mph)).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; 1.7m/s + 1.1m/s.</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; 1.7m/s + 2.2m/s.</li> </ul> <p>If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted.</p> </li> <li>• Vehicle &gt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; (6%×Vref).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; (6%×Vref + 1.1m/s).</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; (6%×Vref + 2.2m/s).</li> </ul> <p>V_ref : Vehicle Reference Speed</p> </li> <li>• Detection filter time <ul style="list-style-type: none"> <li>- Response and detection filter time depend on the amount of the speed difference and additional conditions as shown below. <ol style="list-style-type: none"> <li>1. 18s - if fault threshold is exceeding &gt; 1.7m/s resp.6%</li> <li>2. 9s - if fault threshold is exceeding &gt; 3.3m/s resp. 12%</li> <li>3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s.</li> <li>4. If spinning wheel is detected the fault detection filter time is not shorter than 72s.</li> </ol> </li> </ul> </li> <li>• Fault allocation <p>If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s. Otherwise a general WSS_Generic faulty (C1213) is set.</p> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>• Main Monitoring <ul style="list-style-type: none"> <li>- The main monitor needs additional information of the ESC-sensors and is active for a velocity &gt; 20 km/h(12.4 mph) and no under voltage is detected.</li> </ul> </li> <li>• Backup Monitoring <ul style="list-style-type: none"> <li>- Continuous</li> </ul> </li> </ul>	
		<ul style="list-style-type: none"> <li>• Main Monitoring</li> </ul>	

Case4 - ESC Only	Enable Conditions	<div>1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%.</div> <div>2. Detection filter time : - the above conditions apply for 20s for 1 defective wheel speed sensor. - the above conditions apply for 40s for 2 defective wheel speed sensor. If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set.</div> <div>• Backup Monitoring</div> <div>1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h(31.1 mph).</div> <div>2. When the velocity is below 50 km/h(31.1 mph), if the deviation exceeds an absolute value of 3km/h(1.9 mph).</div> <div>3. Detection filter time : normally 20s - In case of a detected curve, the threshold is increased with an additional value of 4 km/h(2.5 mph).</div>
Fail Safe		<div>• Sensor failure outside of the ABS control cycle</div> <div>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</div> <div>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</div> <div>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</div> <div>• Sensor failure inside the ABS control cycle</div> <div>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</div> <div>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</div> <div>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</div>

2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h(31.1 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

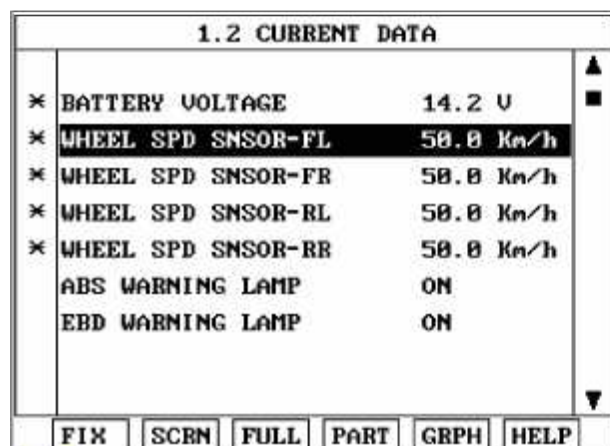


Fig1

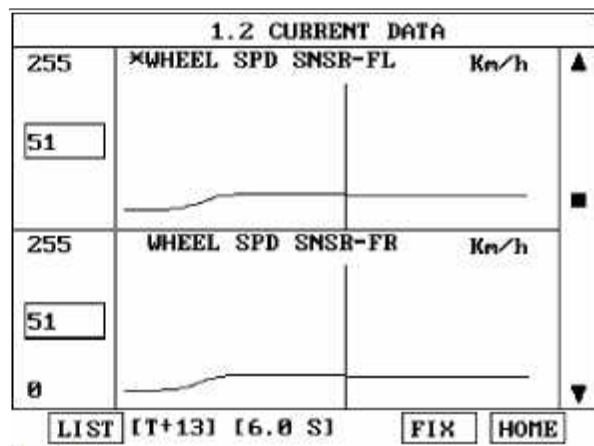


Fig2

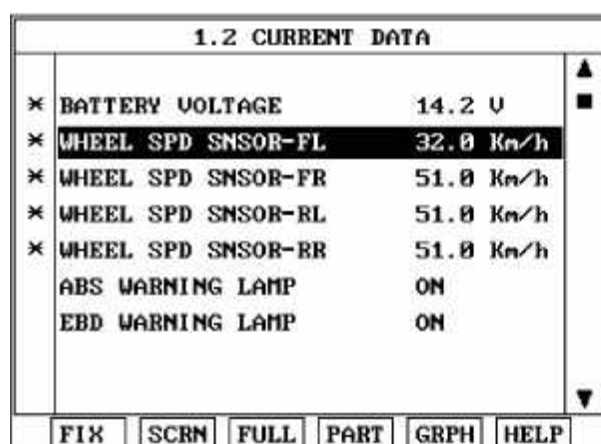


Fig3

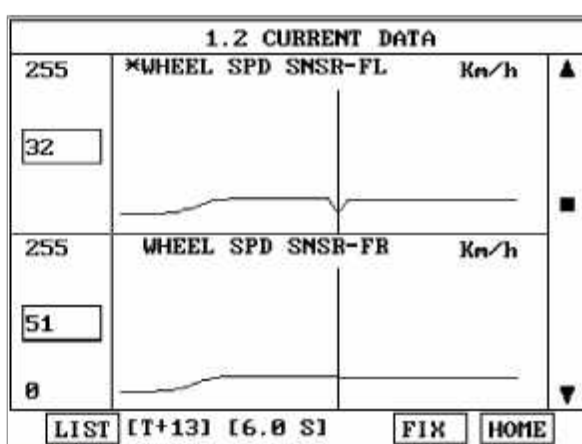


Fig4

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31.1 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Normal Graph

Fig 3) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Data

Fig 4) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Graph

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

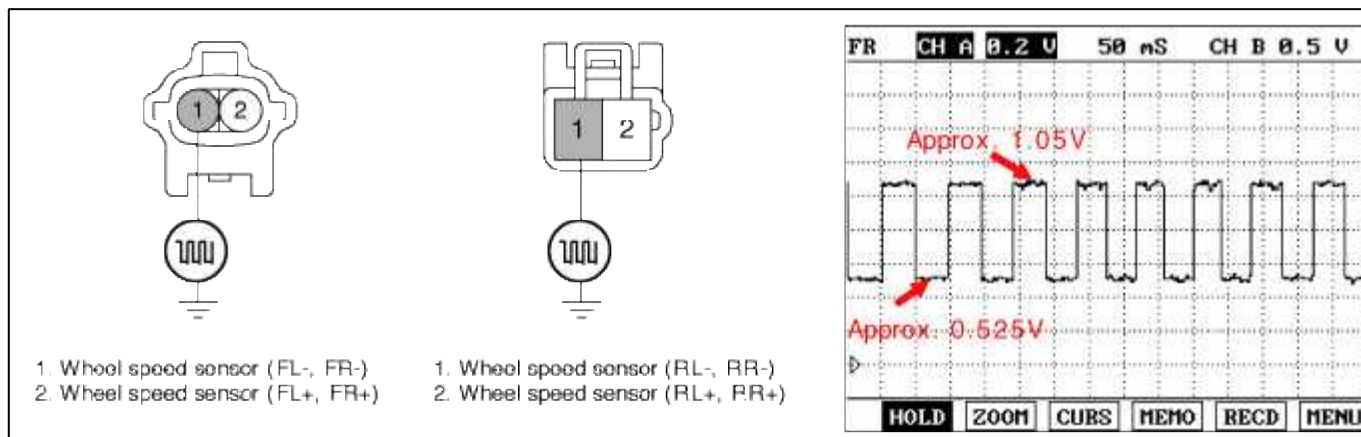
Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

4. Measure waveform between terminal "FL, FR : , RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h (31.1 mph))
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

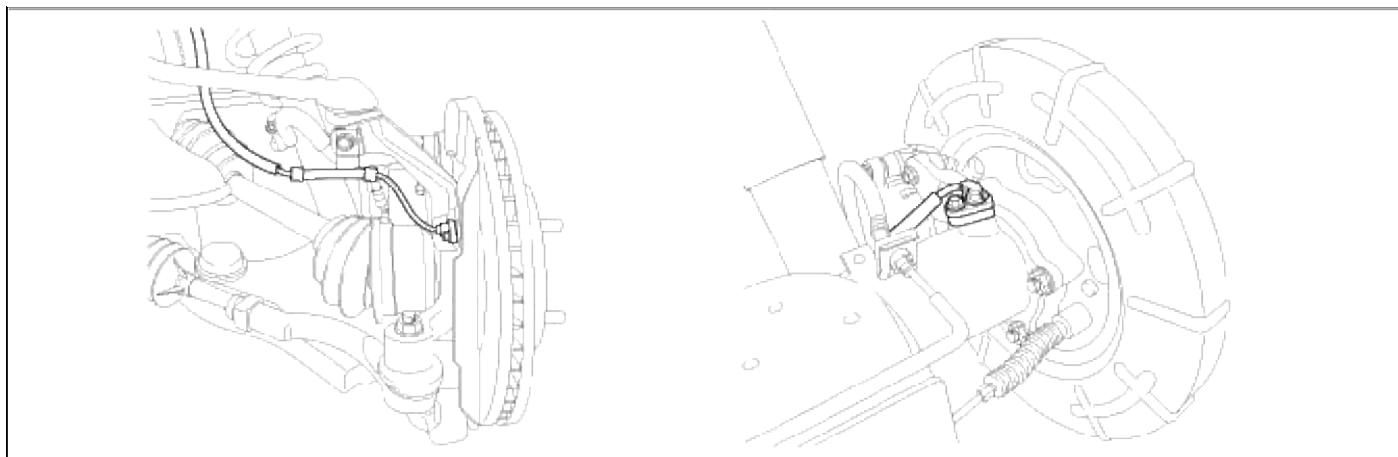
**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1209

#### COMPONENT LOCATION





### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized. In case of a WSS power line short to V<sub>batt</sub>, this FSA test will detect an under voltage failure. (ABS only)</li> <li>FSA test : fail save circuit test</li> <li>UZ : Ignition Voltage</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>When the sensor current levels are out of permissible range (LOW : 7 mA, HIGH : 14 mA) for 200 ms.</li> </ul>	
		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle</li> </ul>	

Fail Safe	<ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> <ul style="list-style-type: none"> <li>• Sensor failure inside the ABS control cycle <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of Wheel speed sensor circuit</li> <li>• Inoperative Wheel speed sensor</li> <li>• Inoperative HECU</li> </ul>
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#### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6.2 mph)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

---

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

---

1.2 CURRENT DATA		
✖ BATTERY VOLTAGE	14.2 V	▲
✖ WHEEL SPD SENSOR-FL	10.0 Km/h	■
✖ WHEEL SPD SENSOR-FR	10.0 Km/h	
✖ WHEEL SPD SENSOR-RL	10.0 Km/h	
✖ WHEEL SPD SENSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig1

1.2 CURRENT DATA		
✖ BATTERY VOLTAGE	14.2 V	▲
✖ WHEEL SPD SENSOR-FL	0.0 Km/h	■
✖ WHEEL SPD SENSOR-FR	10.0 Km/h	
✖ WHEEL SPD SENSOR-RL	10.0 Km/h	
✖ WHEEL SPD SENSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 10km/h or more. (6.2mph or more) Normal D

Fig 2) Test Condition : Drive vehicle at a speed of 10km/h or more. (6.2mph or more) Abnormal Data (Open)

### 5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

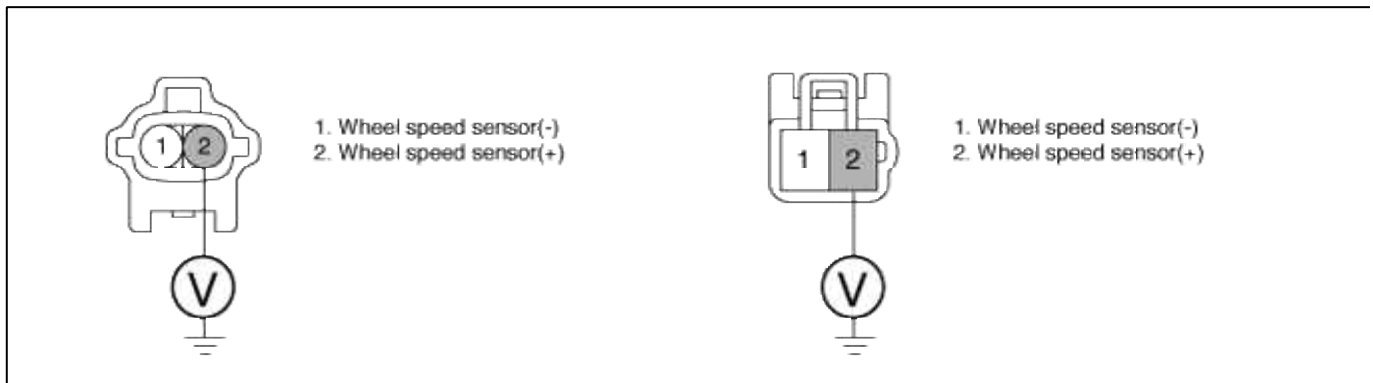
Go to "Power Circuit Inspection" procedure.

### Power Supply Circuit Inspection

1. Ignition "ON".

2. Measure voltage between terminal (FL, FR : 2, RL, RR : 2) of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



3. Is the measured voltage within specifications?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 2, RL, RR : 2" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

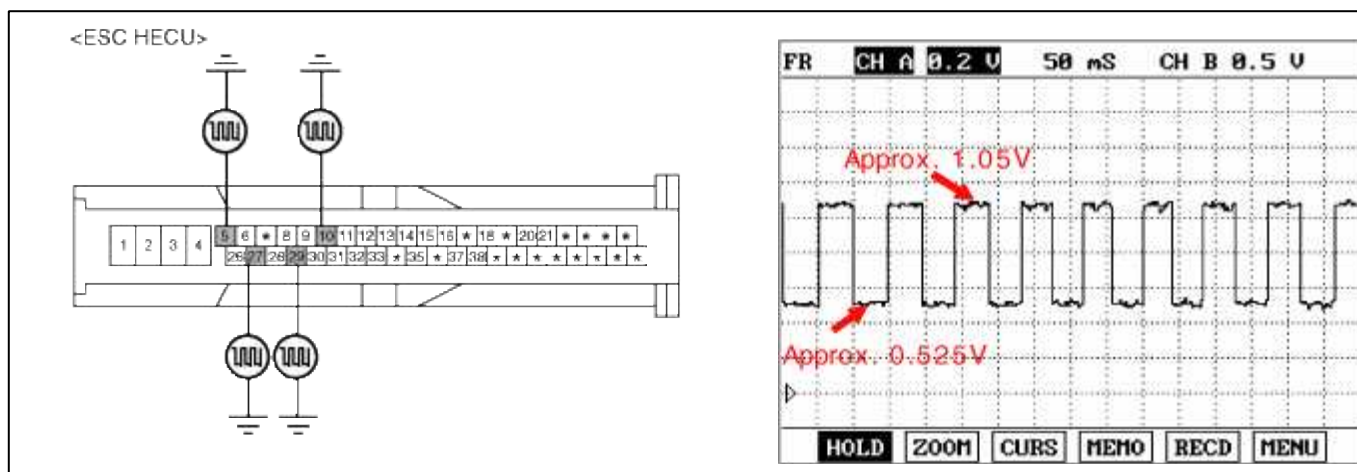
DTC	LOCATION	HECU harness connector (Power supply)	
		ABS	ESC
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

#### Signal Circuit Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

## 4. Measure waveform between terminal of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESC
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

## 5. Is the measured waveform within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

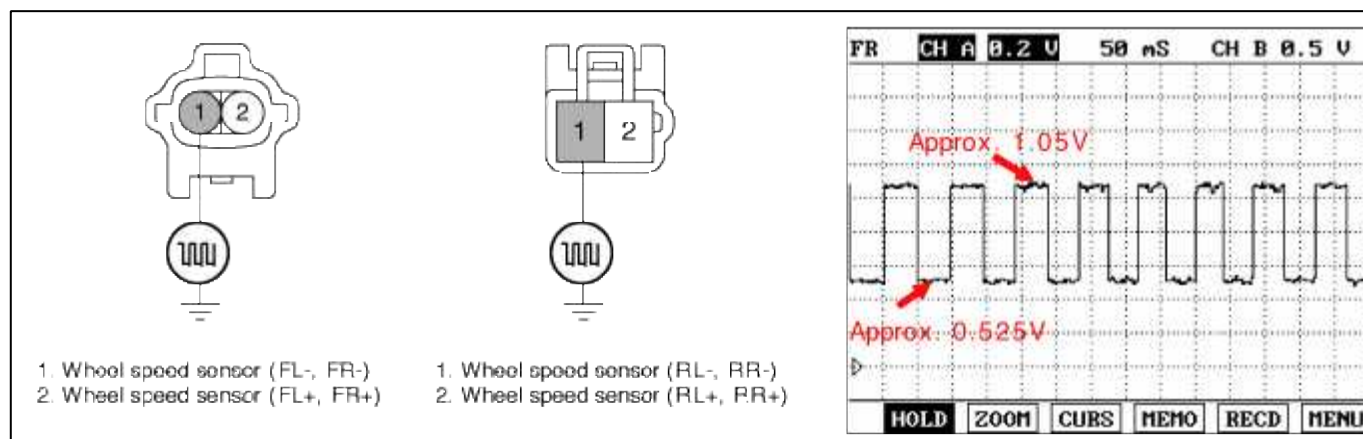
If OK, Go to "Component Inspection" procedure.

## Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

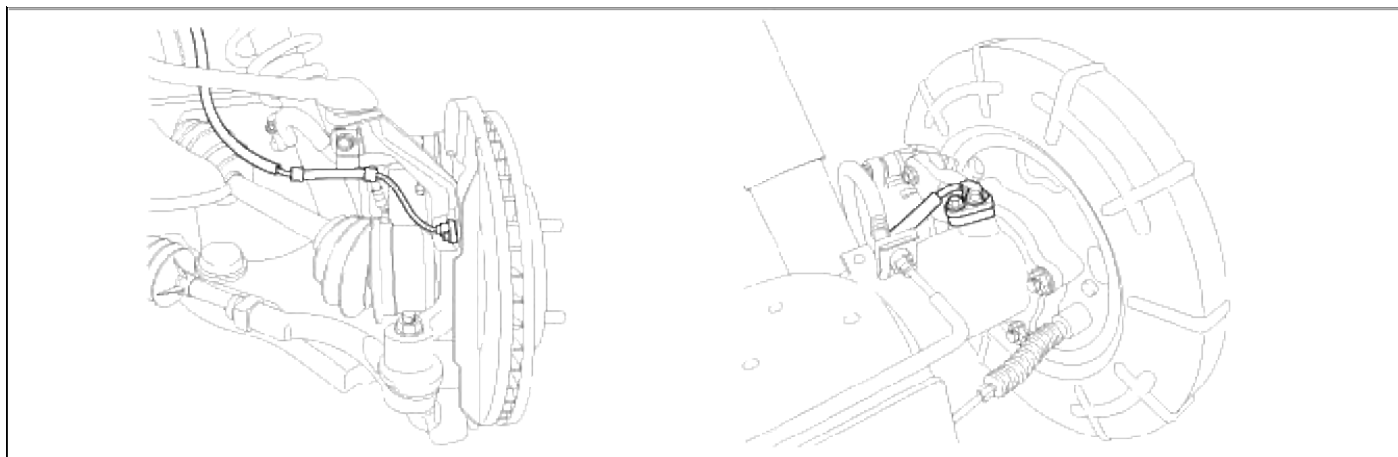
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1210

### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h(6.2 mph to 49.7 mph). Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h(7.5 mph).

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>The monitoring is active from 10 km/h to 80 km/h(6.2 mph to 49.7 mph) and if no ABS-control is active at a front wheel and a rear wheel.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If following interference and signal disturbance is detected, a failure is set after 10 s.</li> <li>non-plausible high frequency received.</li> <li>non-plausible high wheel acceleration.</li> <li>non-plausible high wheel jurk.</li> <li>non-plausible delta T and edges at low speed.</li> </ul>	

Fail Safe	<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> <li>• External noise</li> </ul>
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#### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h(7.5 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

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Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition

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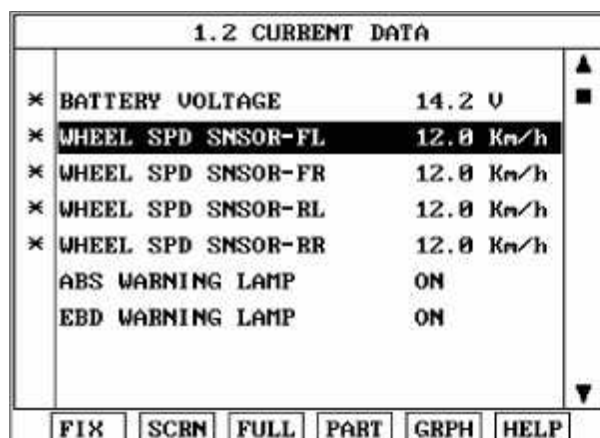


Fig1

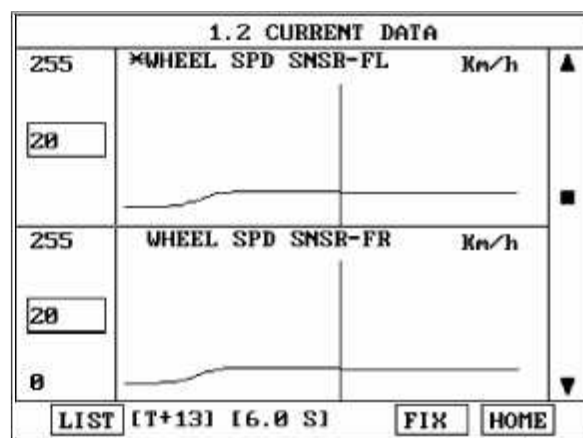


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 12 km/h or more. (7.5mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 20 km/h or more. (12.4mph or more) Normal Graph

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

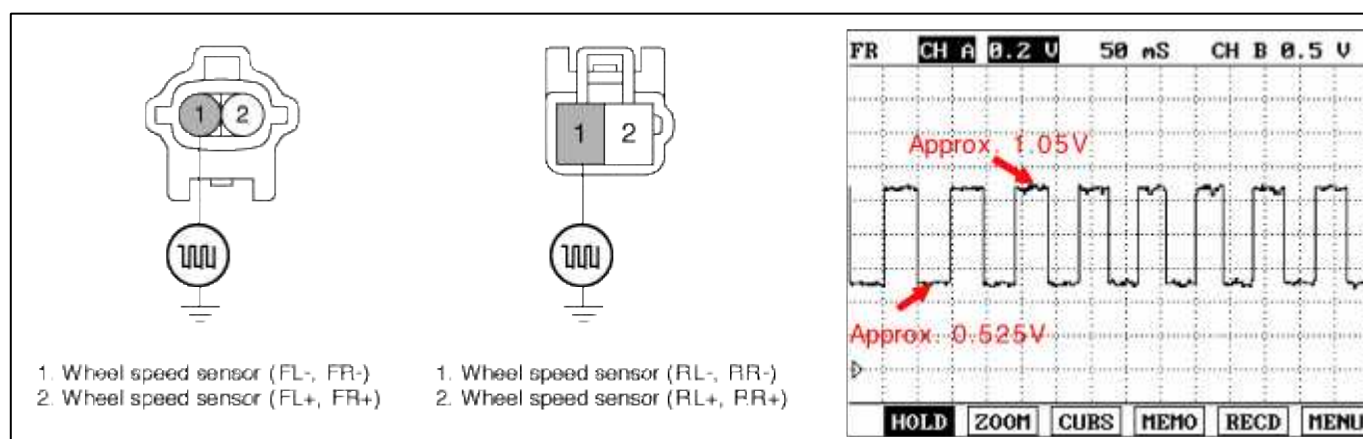
**NO**

Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h (7.5 mph))
4. Are any DTCs present ?

**YES**

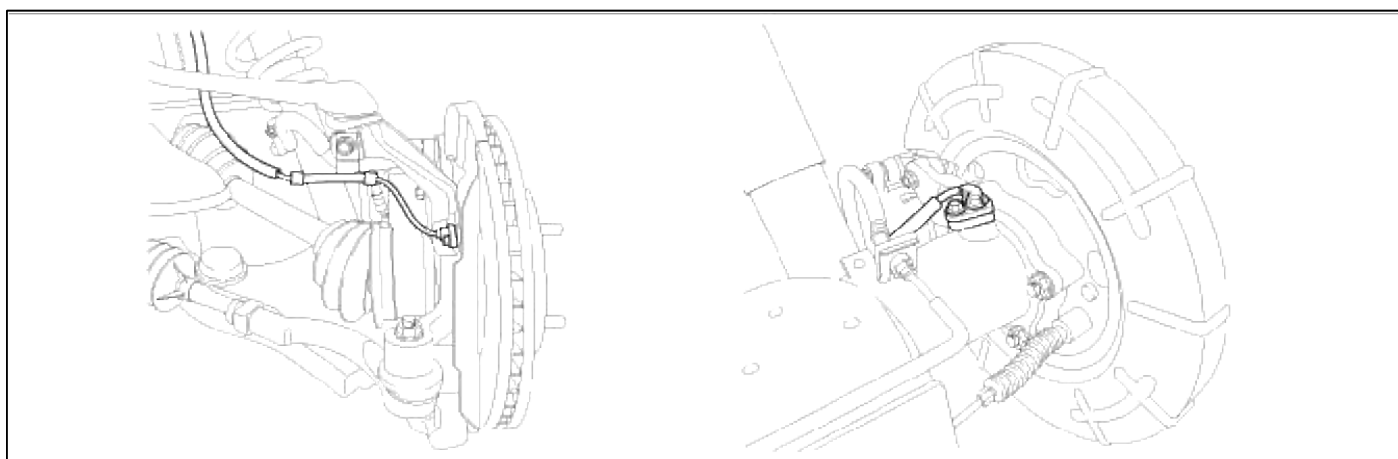
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1211

### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic.

Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h(26.8 mph) or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h(1.7 mph) while the vehicle speed is at 12 km/h(7.5 mph). Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h(7.5 mph).

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	
Case1	Monitoring Period	• Continuous (only no under voltage is not detected)	
	Enable Conditions	<ul style="list-style-type: none"> <li>• If one (or two) wheel are at 2.75 km/h(1.7 mph) and the other wheels are above 12 km/h(7.5 mph) for longer than 1s.</li> <li>• During driving, when the vehicle accelerates 18 km/h(11.2 mph) after a particular wheel speed gets to 2.75 km/h(1.7 mph) and stays there. At that time, If one (or two) wheel are at 2.75 km/h(1.7 mph). <ul style="list-style-type: none"> <li>- This monitoring is performed at the following condition. <ol style="list-style-type: none"> <li>1. At the time the vehicle is accelerated to 12 km/h(7.5 mph).</li> <li>2. Once after energizing the system.</li> <li>3. If the vehicle was stationary for approx. 2s.</li> </ol> </li> </ul> </li> <li>• If one (or two) wheels are under 5 km/h(3.1 mph) and the two fastest wheels have a velocity above 12 km/h(7.5 mph) for more than 20s.</li> </ul>	
	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous ( If vehicle speed &gt; 12 m/s) <ul style="list-style-type: none"> <li>- but this monitoring is disabled in the following event <ol style="list-style-type: none"> <li>1. Aquaplaning.</li> <li>2. Interference.</li> <li>3. Supply voltage below 7.6 or above 18 Volts</li> </ol> </li> </ul> </li> </ul>	
Case2	Enable Conditions	<ul style="list-style-type: none"> <li>• No wheel speed signals within 10 ms to 20 ms at a vehicle speed &gt; 12 m/s (43.2 km/h(26.8 mph)). <ul style="list-style-type: none"> <li>- If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</li> <li>- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.</li> </ul> </li> </ul>	
	Monitoring Period	• Continuous	

Case3 - ABS Only	Enable Conditions	<ul style="list-style-type: none"> <li>• Vehicle &lt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; 1.7m/s (6km/h(3.7mph)).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; 1.7m/s + 1.1m/s.</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; 1.7m/s + 2.2m/s.</li> </ul> <p>If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted.</p> </li> <li>• Vehicle &gt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; (6%×Vref).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; (6%×Vref + 1.1m/s).</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; (6%×Vref + 2.2m/s).</li> </ul> <p>V_ref : Vehicle Reference Speed</p> </li> <li>• Detection filter time <ul style="list-style-type: none"> <li>- Response and detection filter time depend on the amount of the speed difference and additional conditions as shown below. <ol style="list-style-type: none"> <li>1. 18s - if fault threshold is exceeding &gt; 1.7m/s resp. 6%</li> <li>2. 9s - if fault threshold is exceeding &gt; 3.3m/s resp. 12%</li> <li>3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s.</li> <li>4. If spinning wheel is detected the fault detection filter time is not shorter than 72s.</li> </ol> </li> </ul> </li> <li>• Fault allocation <p>If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s. Otherwise a general WSS_Generic faulty (C1213) is set.</p> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>• Main Monitoring <ul style="list-style-type: none"> <li>- The main monitor needs additional information of the ESC-sensors and is active for a velocity &gt; 20 km/h(12.4 mph) and no under voltage is detected.</li> </ul> </li> <li>• Backup Monitoring <ul style="list-style-type: none"> <li>- Continuous</li> </ul> </li> </ul>	
		<ul style="list-style-type: none"> <li>• Main Monitoring</li> </ul>	

Case4 - ESC Only	Enable Conditions	<div>1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%.</div> <div>2. Detection filter time : - the above conditions apply for 20s for 1 defective wheel speed sensor. - the above conditions apply for 40s for 2 defective wheel speed sensor. If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set.</div> <div>• Backup Monitoring</div> <div>1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h(31.1 mph).</div> <div>2. When the velocity is below 50 km/h(31.1 mph), if the deviation exceeds an absolute value of 3km/h(1.9 mph).</div> <div>3. Detection filter time : normally 20s - In case of a detected curve, the threshold is increased with an additional value of 4 km/h(2.5 mph).</div>
Fail Safe		<div>• Sensor failure outside of the ABS control cycle</div> <div>1. Only one wheel failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</div> <div>2. Two wheels failure : Only the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</div> <div>3. More than 3 wheels failure :System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</div> <div>• Sensor failure inside the ABS control cycle</div> <div>1. One front wheel failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</div> <div>2. Two wheels failure : Inhibit the ABS/ESC control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESC control, the ABS/ESC functions are inhibited. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</div> <div>3. More than 3 wheels failure : System down. The ABS/EBD/ESC functions are inhibited. The ABS/EBD/ESC warning lamps are activated.</div>

## Monitor Scantool Data

1. Engine "ON".

2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h(31.1 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

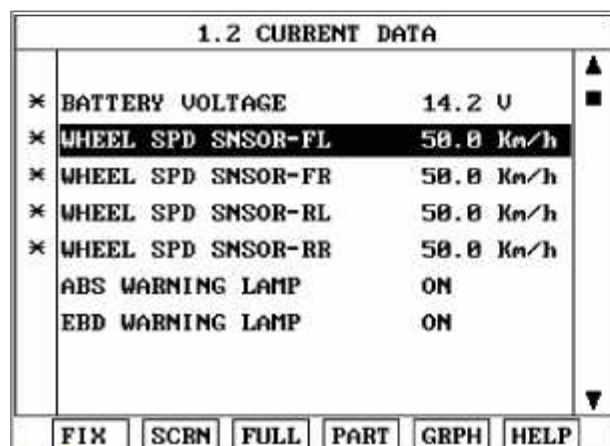


Fig1

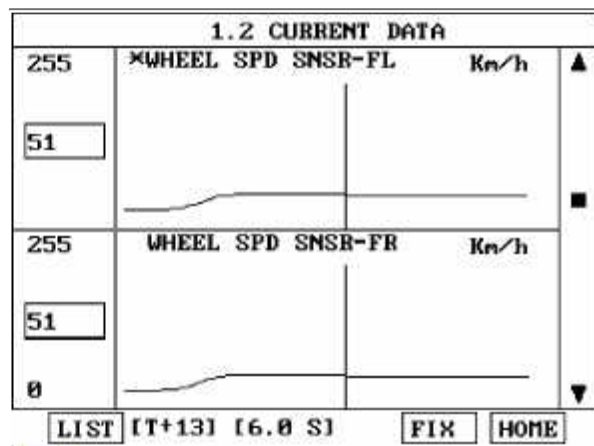


Fig2

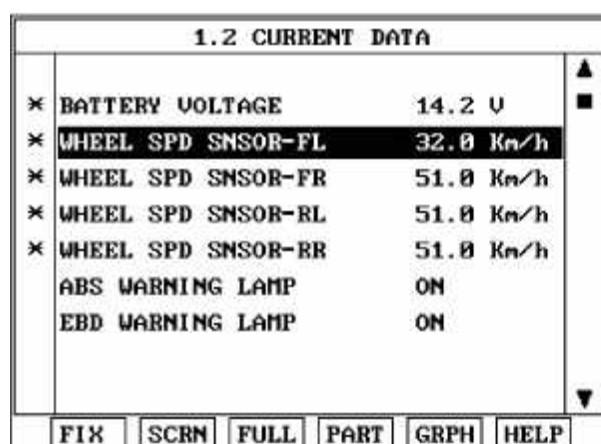


Fig3

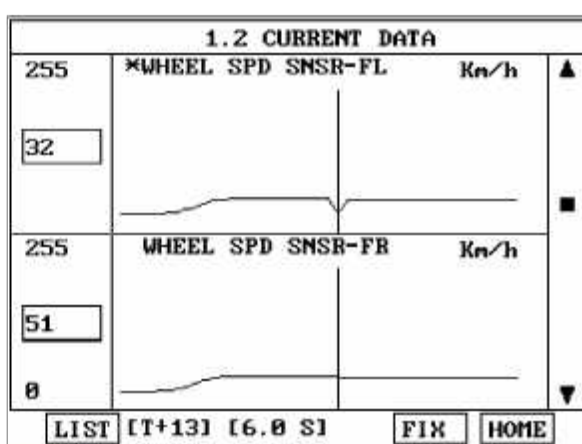


Fig4

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31.1 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Normal Graph

Fig 3) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Data

Fig 4) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Graph

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

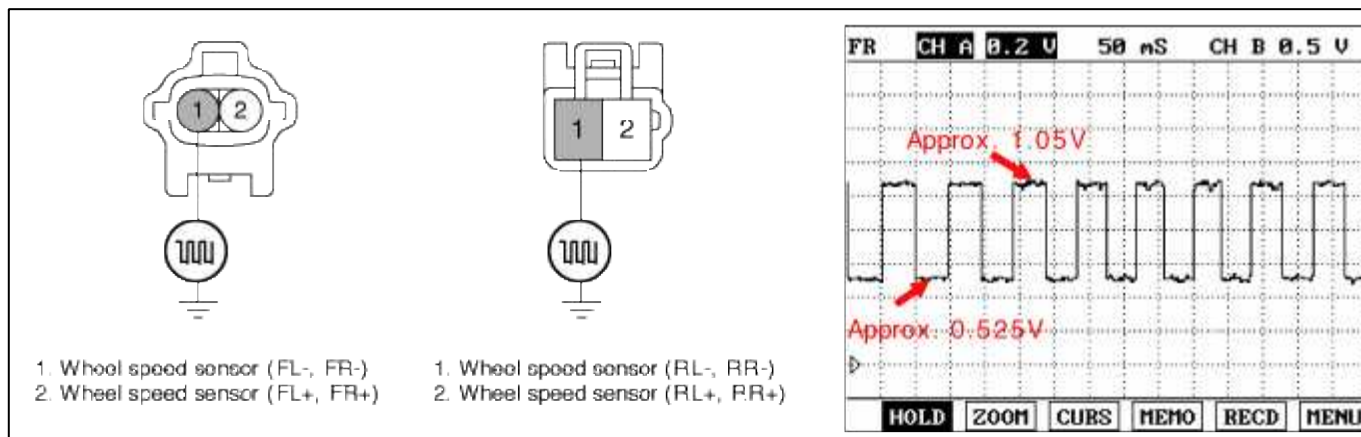
Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

4. Measure waveform between terminal "FL, FR : , RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h (31.1 mph))
4. Are any DTCs present ?

**YES**

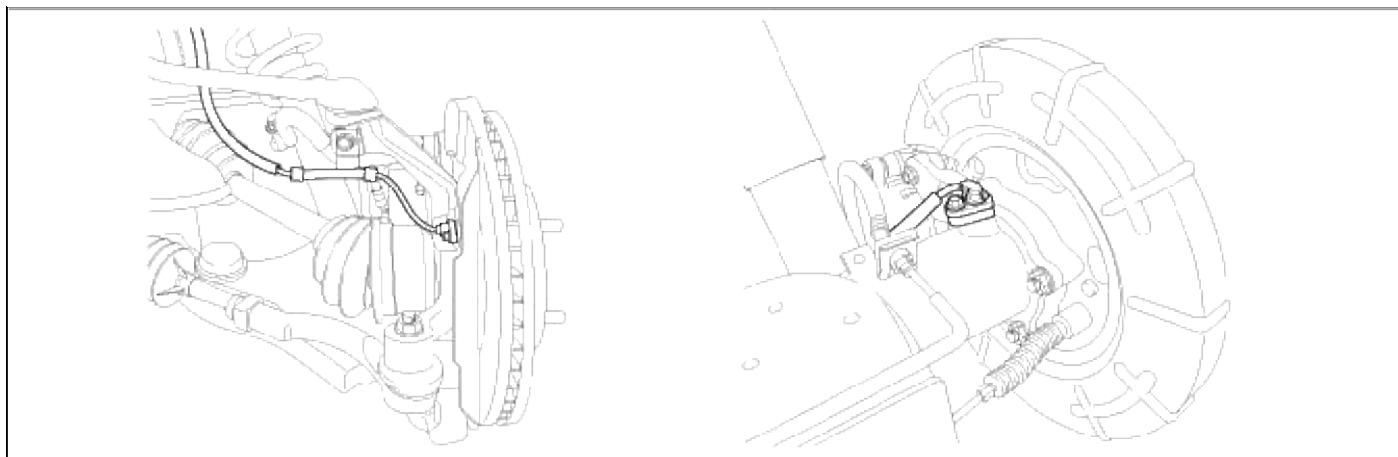
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1213

#### COMPONENT LOCATION



### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall IC-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to speed of the rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set, if the speed difference with adjacent wheel is out of permissible range or the ABS control cycle is abnormal.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
Case 1	DTC Strategy	• Signal monitoring	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Monitoring Period	• Continuous	
	Enable Conditions	• When short cut between the wheel speed sensor supply and the battery.	
	Fail Safe	• Wheel speed sensor signals are not reliable.	
Case 2	DTC Strategy	• Signal monitoring	
	Monitoring Period	• Continuous	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The monitoring reports a failure if the ABS target slip is exceeded for a time period <math>\geq 10</math> s at one or more wheels.</li> <li>- If the driver brakes or the velocity is lower than 50 km/h the detection time is enlarged to 60 s.</li> </ul>	
	Fail Safe	• Reduced function of the ESC system	



## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6.2 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	
* WHEEL SPD SENSOR-FL	50.0 Km/h	
* WHEEL SPD SENSOR-FR	50.0 Km/h	
* WHEEL SPD SENSOR-RL	50.0 Km/h	
* WHEEL SPD SENSOR-RR	50.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig1

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	
* WHEEL SPD SENSOR-FL	32.0 Km/h	
* WHEEL SPD SENSOR-FR	51.0 Km/h	
* WHEEL SPD SENSOR-RL	51.0 Km/h	
* WHEEL SPD SENSOR-RR	51.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31.1 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31.7 mph or more) Abnormal Data

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure..

**NO**

Go to "Component Inspection" Procedure.

## Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.

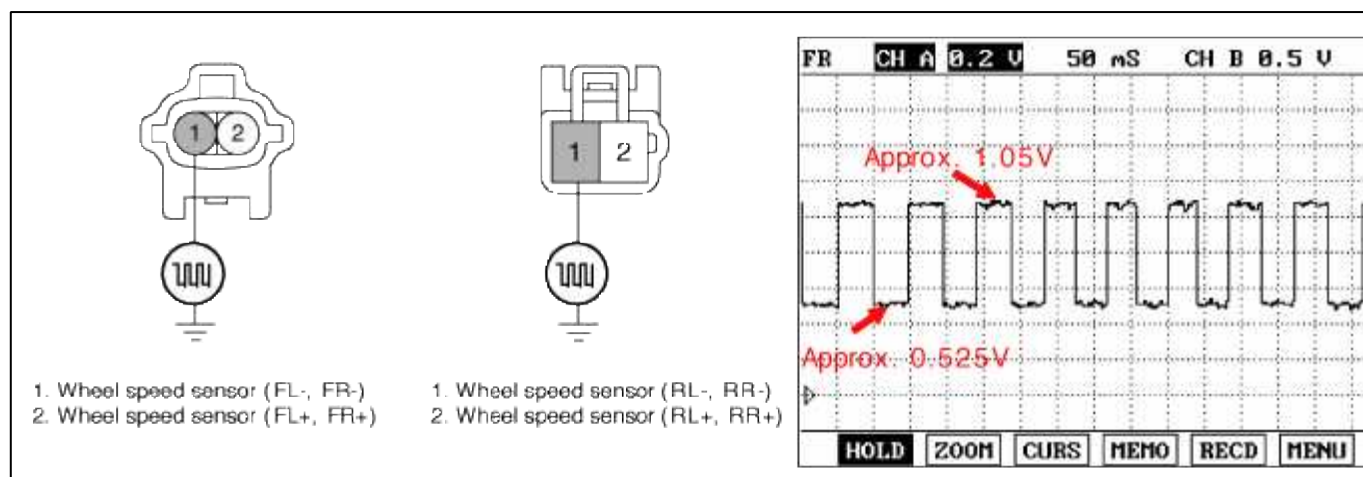
4. Measure waveform between terminal "1" of the wheel speed sensor harness connector and chassis ground.

Specification :

High : 1.05 V , Low : 0.525 V

Compare waveforms of all wheel speed sensors.

If they have same waveform, it is in normal condition.



5. Is the measured waveform within specifications?

**YES**

Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check following point at wheel speed sensor which has abnormal waveform.

Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31.1mph or more))
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1235

#### COMPONENT LOCATION



### General Description

The pressure sensor, installed in the HECU, sense the brake oil pressure to judge driver's brake intention when ESC is operating. If pressure of master cylinder is applied to pressure sensor, the strain of the piezo element is changed and then the resistance of bridge circuit is changed according to changed strain. Therefore this changed resistance changes output voltage of bridge circuit and output voltage changes linearly. The sensor output is a analog signal in proportion to supply voltage, and the HECU recognizes a pressure value according to signal ratio about supply voltage.

### DTC Description

Each unfiltered input signal voltage is monitored to be in the range of  $4.7\text{ V} < \text{input signal voltage} < 5.3\text{ V}$ . A failure is detected if the output signal value is out of specified range for more than 100 ms or pressure sensor self test form is out of specification during self test.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage Monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A sensor supply failure is detected if Sensor Supply Voltage <math>&gt; 5.3\text{ V}</math> or Sensor Supply Voltage <math>&lt; 4.7\text{ V}</math> for <math>t \geq 60\text{ ms}</math>.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A Fault is set if the DSO signal is voltage of DSO <math>&gt; 4.7\text{ V}</math> or voltage of DSO <math>&lt; 0.3\text{ V}</math> for a time <math>t \geq 100\text{ ms}</math>. - DSO : original pressure value.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A Fault is set if the DSI signal is voltage of DSI <math>&gt; 4.7\text{ V}</math> or voltage of DSI <math>&lt; 0.3\text{ V}</math> for a time <math>t \geq 100\text{ ms}</math>. - DSI : inverted pressure value.</li> </ul>	

Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of pressure sensor circuit</li> <li>• Inoperative pressure sensor</li> <li>• Inoperative HECU</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is set if the voltage of DSO + DSI <math>&gt; 5.5V</math> or voltage of DSO + DSI <math>&lt; 4.5V</math> for a time <math>t \geq 100ms</math>.</li> <li>- DSO : original pressure value.</li> <li>- DSI : inverted pressure value.</li> </ul>	
Case 5	Monitoring Period	<ul style="list-style-type: none"> <li>• Once during Power Up</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• POS detects internal sensor malfunctions (sensor element, amplification, etc.). The POS is triggered if no low voltage is present and supply voltage is switched on. The test phase is divided in two 60 ms parts. DSO signal must be <math>&lt; 0.5 V</math> for 30 ms. In phase 2 DSO signal must be between 1.9V and 3.1V for also 30 ms then the POS Test is passed. The test phase is divided in two 60 ms parts. DSO and DSI signal must be <math>&lt; 0.5 V</math> for 30 ms. In phase 2 DSO and DSI signal must be between 1.9 V and 3.1 V for also 30 ms then the POS Test is passed. A fault is set if POS does not satisfy the above conditions</li> <li>- POS : Power on selftest.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• No Pressure Signal available..</li> <li>• Sensor failure outside the ABS control cycle <ul style="list-style-type: none"> <li>- Only the ABS/ESC functions are inhibited, allow the EBD. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> </ul> </li> <li>• Sensor failure inside the ABS control cycle <ul style="list-style-type: none"> <li>- Inhibit the ESC control, allow the EBD. The ESC warning lamps are activated. After the control, the ABS functions are inhibited. The ABS warning lamps are activated.</li> </ul> </li> </ul>	

#### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Press the brake pedal.

#### 4. Monitor the "Pressure Sensor" parameter on the Scantool.

Specification : Approx. 60 bar ~150 bar (There are difference in displayed parameter according to braking force)

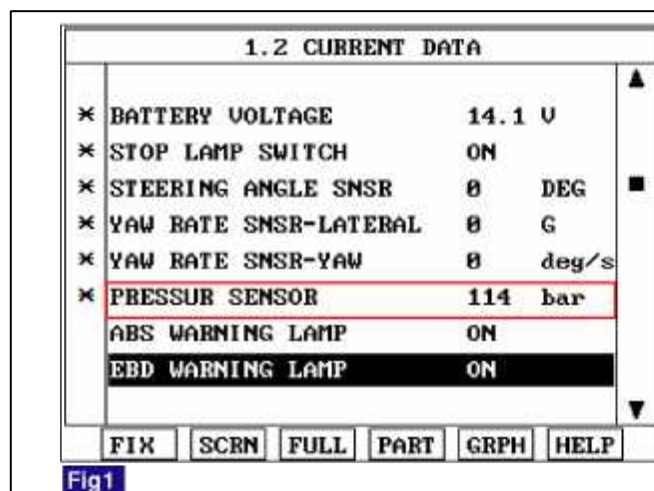


Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed parameter according to braking force)

#### 5. Whenever brake pedal is pushed down, is the pressure sensor's scantool data changed?

**YES**

Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

#### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information

4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1237

### COMPONENT LOCATION



### General Description

The pressure sensor, installed in the HECU, sense the brake oil pressure to judge driver's brake intention when ESC is operating. If pressure of master cylinder is applied to pressure sensor, the strain of the piezo element is changed and then the resistance of bridge circuit is changed according to changed strain. Therefore this changed resistance changes output voltage of bridge circuit and output voltage changes linearly. The sensor output is a analog signal in proportion to supply voltage, and the HECU recognizes a pressure value according to signal ratio about supply voltage.

### DTC Description

With the driver torque demand and the lateral acceleration a driver braking demand is calculated. Unless the pump motor is operating or there is a brake signal, The offset compensation is executed. A failure is detected if offset value exceeded  $\pm 15$  bar.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Voltage Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of pressure sensor circuit</li> <li>• Inoperative pressure sensor</li> <li>• Inoperative HECU</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>• After Pressure sensor initialization.</li> <li>• No under voltage</li> <li>• No pumps are running.</li> <li>• No BLS-signal is set.</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>• The pressure sensor-offset value must be in the range of <math>\pm 15</math> bar. A failure is detected if this range is exceeded.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>• Reduced function caused by faulty pressure sensor signal.</li> <li>• Sensor failure outside the ABS control cycle               <ul style="list-style-type: none"> <li>- Only the ABS/ESC functions are inhibited, allow the EBD. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.</li> </ul> </li> <li>• Sensor failure inside the ABS control cycle               <ul style="list-style-type: none"> <li>- Inhibit the ESC control, allow the EBD. The ESC warning lamps are activated. After the control, the ABS functions are inhibited. The ABS warning lamps are activated.</li> </ul> </li> </ul>	

#### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Press the brake pedal.
4. Monitor the "Pressure Sensor" parameter on the Scantool.

Specification : Approx. 60 bar ~150 bar (There are difference in displayed parameter according to braking force)

1.2 CURRENT DATA		
✖ BATTERY VOLTAGE	14.1	V
✖ STOP LAMP SWITCH	ON	
✖ STEERING ANGLE SNSR	0	DEG
✖ YAW RATE SNSR-LATERAL	0	G
✖ YAW RATE SNSR-YAW	0	deg/s
✖ PRESSUR SENSOR	114	bar
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	

FIX SCR FULL PART GRPH HELP

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed parameter according to braking force)

5. Whenever brake pedal is pushed down, is the pressure sensor's scantool data changed?

**YES**

Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1260

### COMPONENT LOCATION





## General Description

The Steering angle sensor(SAS) is joined to the multi function switch and uses a CAN communication. The SAS is used to determine turning direction and speed of the steering wheel. The HECU uses the signals from the SAS when performing ESC-related calculations.

## DTC Description

If the SAS signal is different from calculated value by yaw-rate sensor and wheel speed sensor, mechanically impossible SAS signal is detected, there is a difference between SAS signal and driving condition of the vehicle calculated from yaw-rate sensor and lateral G sensor, a failure is detected.

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal Monitoring	
Case 1	Monitoring Period	• Continuous	
	Enable Conditions	• During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered SAS-value is equivalent to the offset. If the offset value exceeds a threshold of approximately 15 deg a SAS-fault is determined. Failure detection time depends on the driving distance, vehicle speed and on the amount of failed SAS signal. Within 30 km(18.6 mile) of symmetrical driving the calculated offset corresponds to the sensor offset.	
Case 2	Monitoring Period	• Continuous (If the following conditions are satisfied) 1. After SAS-initialization and vehicle reference speed > 1.4 m/s (5 km/h(3.1 mph)) 2. No under voltage 3. At least one SAS-message was sent in the current 20 ms-cycle.	
	Enable Conditions	• A SAS-gradient-failure is set, if 1. Signal gradient (steering angle velocity) from one 20 ms-cycle to another is higher than 40° or 2. Change of this gradient (steering angle acceleration) is higher than 15° : $ (LwInK0K1 - LwInK1K2)  > 15^\circ$ and $ (LwInK0K1 + LwInK1K2)  > 15^\circ$ - LwInK0K1 : Difference of the SAS-signal between the current 20 ms-cycle and the last 20 ms-cycle. - LwInK1K2 : Difference of the SAS-signal between the last 20 ms-cycle and 20 ms-cycle before.	
Case 3	Monitoring Period	• Continuous (After initialization and no under voltage detected)	
	Enable Conditions	• If value is higher than 665° + 90° tolerance for more than 300 ms a fault is determined.	

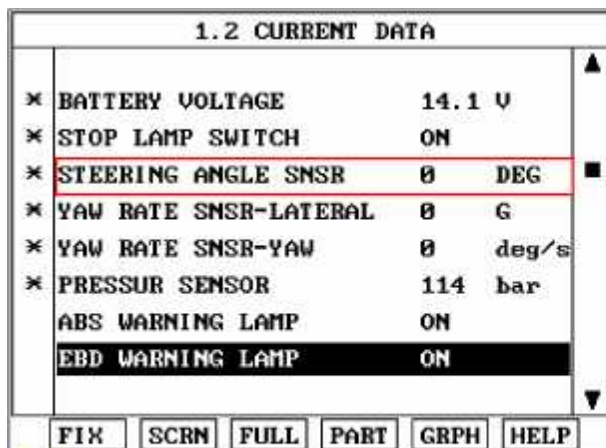
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous (during driving)</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of steering angle sensor circuit</li> <li>• Inoperative steering angle sensor</li> <li>• Wrong SAS calibration</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Based on a vehicle model a reference SAS signal is build. The difference between measured SAS signal and SAS signal calculated from yaw-rate sensor signal is evaluated for fault detection.</li> <li>Dependent on the driving conditions failures in size of <math>[10 + 60 \text{ m/s} / \text{vehicle reference speed}] \text{ deg}</math> at steering angle are recognized within 400 ~ 4800 ms through three possible recognition paths:               <ol style="list-style-type: none"> <li>1. Curve Branch (lateral <math>G &gt; 2 \text{ m/s}^2</math> and left and right curve driving)</li> <li>2. Stability Branch (no large wheel speed differences and stable acceleration)</li> <li>3. Straight ahead Branch (lateral <math>G &lt; 0.5 \text{ m/s}^2</math> and yaw rate <math>&lt; 2 \text{ deg/s}</math>).</li> </ol> </li> <li>The recognition time depends on the active branch (the time is shorter in a relation 1):2):3)-4:2:1) and the value of the permissible time threshold dependent on the deviation between the compared signals (small deviation → long detection time, large deviation → small detection time).</li> </ul>	
Case 5	Monitoring Period	<ul style="list-style-type: none"> <li>• Initialization once in every ignition cycle.</li> <li>• The monitoring is active until a reset by a change in the SAS signal or until a right and left cornering can be recognized.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• If there is no change in the signal, but a right and left cornering has been recognized, a fault is determined. (lateral <math>G &gt; 2 \text{ m/s}^2</math> in combination with a yaw rate <math>&gt; 6 \text{ }^\circ/\text{s}</math> in both directions).</li> <li>- At a minimum change of e.g. <math>5^\circ</math> in the signal, the monitoring is reset.</li> </ul>	
Case 6	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous (during driving)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The measured yaw rate and the yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals don't fit and forwards driving is detected, a fault is determined.</li> </ul>	
Case 7	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous (during driving)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• Under normal conditions, two SAS messages are sent in one 20 ms cycle, which is shown by an increase of the message counter by 2. If the message counter shows an increase higher than 3 or lower than 1 in one 20 ms-cycle, a fault is stored after 160 ms.</li> </ul>	

## Fail Safe

- Reduced controller function caused by inoperative SAS signal. ABS/EBD control is available.
- The ESC warning lamp is activated.

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Turn the steering wheel to the left or right.
4. Monitor the "Steering Angle Sensor" parameters on the Scantool.



1.2 CURRENT DATA		
× BATTERY VOLTAGE	14.1	V
× STOP LAMP SWITCH	ON	
× STEERING ANGLE SNSR	0	DEG
× YAW RATE SNSR-LATERAL	0	G
× YAW RATE SNSR-YAW	0	deg/s
× PRESSUR SENSOR	114	bar
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	

FIX SCRN FULL PART GRPH HELP

Fig1

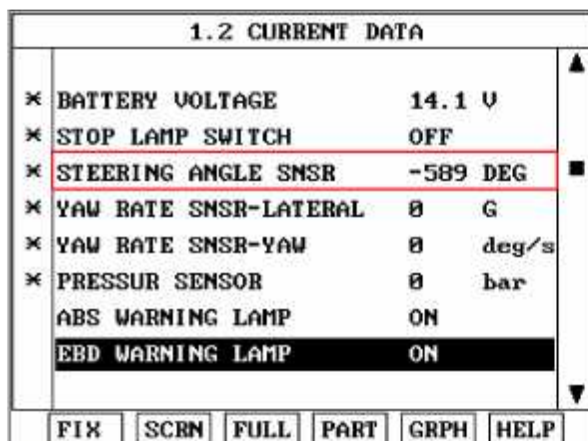
Fig 1) Test Condition : Ignition "ON" & Engine "ON". Normal data

5. Whenever steering wheel is turned, is the steering sensor's scantool data changed?

**YES**

- (1) Connect scantool to Data Link Connector (DLC).
- (2) Ignition "ON" & Engine "ON".
- (3) Turn the steering wheel to the full left or right position.
- (4) Monitor the "steering sensor" parameters on the Scantool.

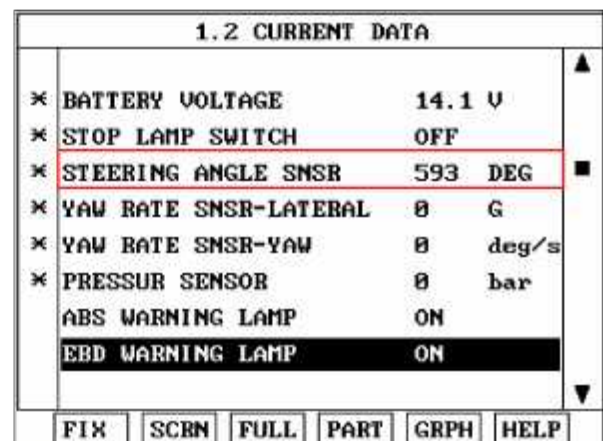
Specification : difference between two parameters is within  $\pm 15\text{deg}$



1.2 CURRENT DATA		
× BATTERY VOLTAGE	14.1	V
× STOP LAMP SWITCH	OFF	
× STEERING ANGLE SNSR	-589	DEG
× YAW RATE SNSR-LATERAL	0	G
× YAW RATE SNSR-YAW	0	deg/s
× PRESSUR SENSOR	0	bar
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	

FIX SCRN FULL PART GRPH HELP

Fig2



1.2 CURRENT DATA		
× BATTERY VOLTAGE	14.1	V
× STOP LAMP SWITCH	OFF	
× STEERING ANGLE SNSR	593	DEG
× YAW RATE SNSR-LATERAL	0	G
× YAW RATE SNSR-YAW	0	deg/s
× PRESSUR SENSOR	0	bar
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	

FIX SCRN FULL PART GRPH HELP

Fig3

Fig 2) Test Condition : Ignition "ON" & Engine "ON". Normal data (Right side)

Fig 3) Test Condition : Ignition "ON" & Engine "ON". Normal data (Left side)

(5) Is parameter displayed within specifications?

**YES**

Go to "W/Harness Inspection" procedure.

**NO**

Go to number 6. procedure.

**NO**

Go to "W/Harness Inspection" procedure.

6. Perform steering angle sensor calibration.

(1) Ignition "ON" & Engine "OFF".

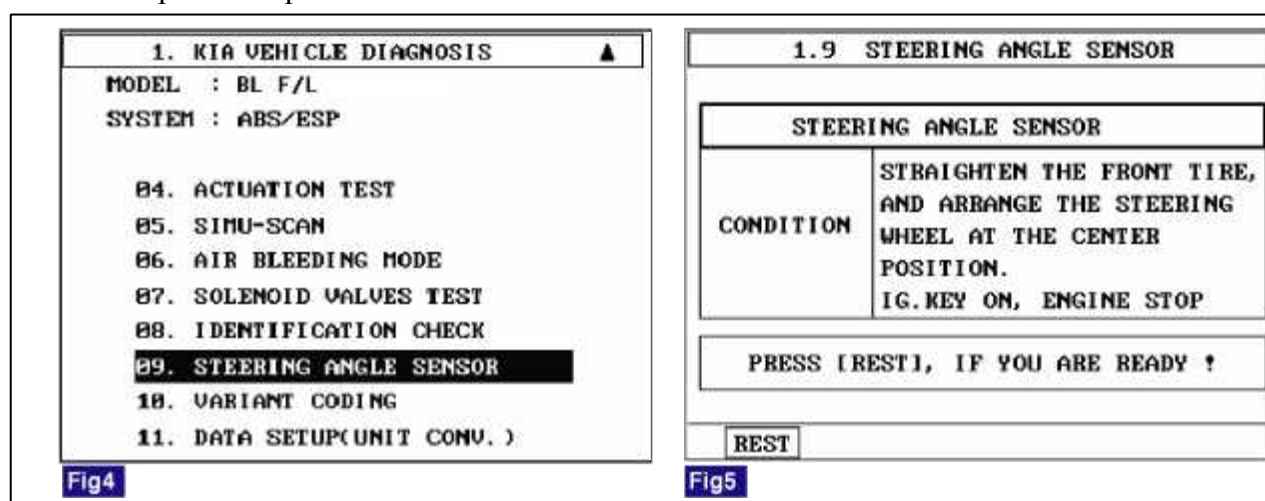
(2) Line up the steering wheel in a straight.

(3) Connect scantool to Data Link Connector(DLC).

(4) Go in Anti-Lock brake system. (figure 4).

(5) Perform steering angle sensor calibration. (figure 5).

(6) Go to "Component Inspection" Procedure.



7. Whenever steering wheel is turned, is the steering sensor's scantool data changed HIGH/LOW?

**YES**

Fault is intermittent caused by poor connection in steering sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Operate the vehicle within DTC Detecting Condition in General Information. (turn right and left at least 1 time)
6. Select "Diagnostic Trouble Codes (DTCs)" mode again.
7. Are any DTCs present ?

**YES**

- (1) Substitute with a known-good steering angle sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.
- (2) Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

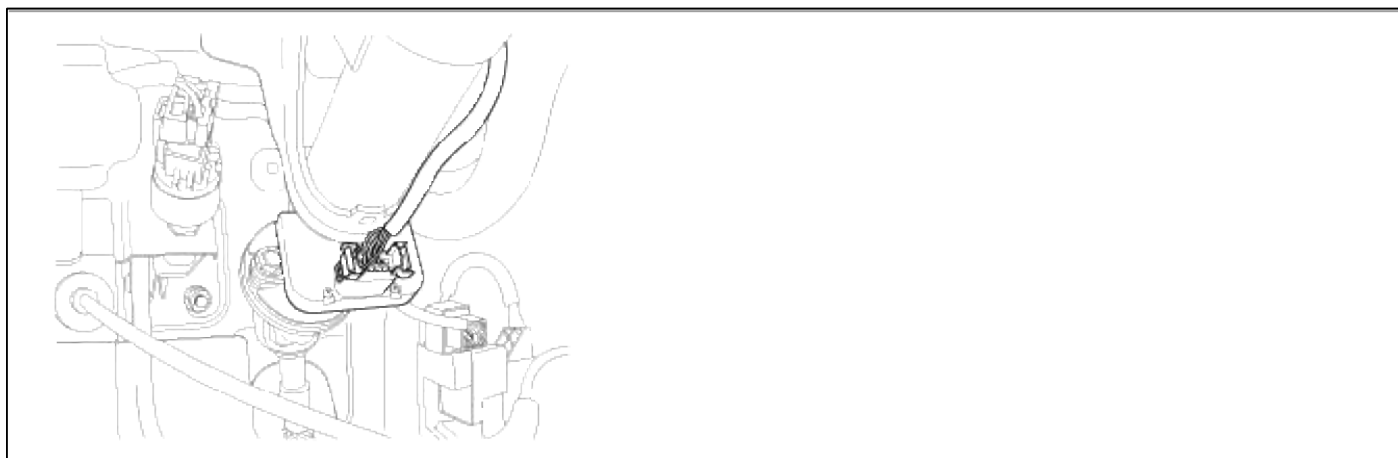
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1261

### COMPONENT LOCATION



### General Description

The Steering angle sensor(SAS) is joined to the multi function switch and uses a CAN communication. The SAS is used to determine turning direction and speed of the steering wheel. The HECU uses the signals from the SAS when performing ESC-related calculations.

### DTC Description

The SAS used for ESC control needs zero point adjustment because the SAS measures an absolute angle. Zero point adjustment is done by using the scantool device. If abnormal zero point adjustment is detected, a failure is recognized.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal Monitoring	• A fail of SAS zero point adjustment
Monitoring Period	• During SAS zero point adjustment.	
Enable Conditions	• The position of steering wheel is out of specified range (straight position, a max. error $\pm 5^\circ$ ) during SAS zero point adjustment.	
Fail Safe	<ul style="list-style-type: none"> <li>• Reduced controller function caused by inoperative SAS signal. ABS/EBD control is available.</li> <li>• The ESC warning lamp is activated.</li> </ul>	

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Monitor the "SAS CALIBRATED" parameters on the Scantool.

Specification : YES

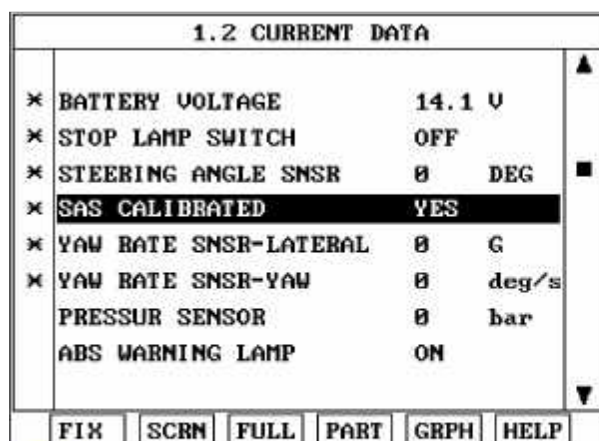


Fig1

Fig 1) SAS Calibrate normal data - YES : SAS calibrated, NO : SAS not calibrated.

4. Is parameter displayed within specifications?

**YES**

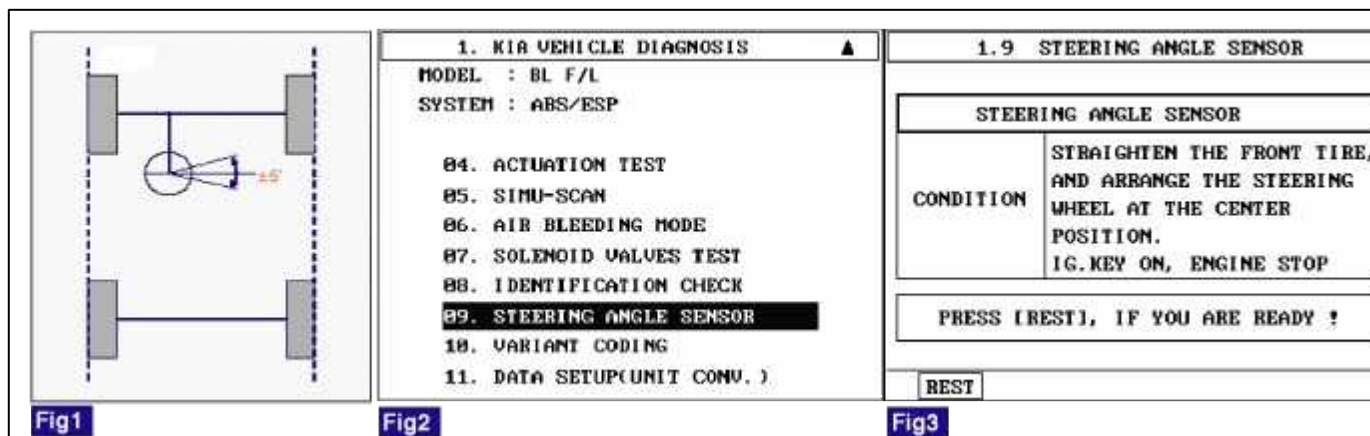
Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

## Component Inspection

1. Line up wheels like (figure 1).
  - (1) Perform the wheel alignment.
  - (2) Line up the steering wheel in a straight line.
  - (3) Go ahead and back the vehicle 2~3 times without holding steering wheel.
2. Connect scantool to Data Link Connector(DLC).
3. Go in Anti-Lock brake system. (figure 2).
4. Perform steering angle sensor calibration. (figure 3).
5. Disconnect scantool.
6. Check the condition of SAS zero point adjustment by operating the vehicle (turn right and left at least 1 time)



7. Is zero point adjustment completed?

**YES**

Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

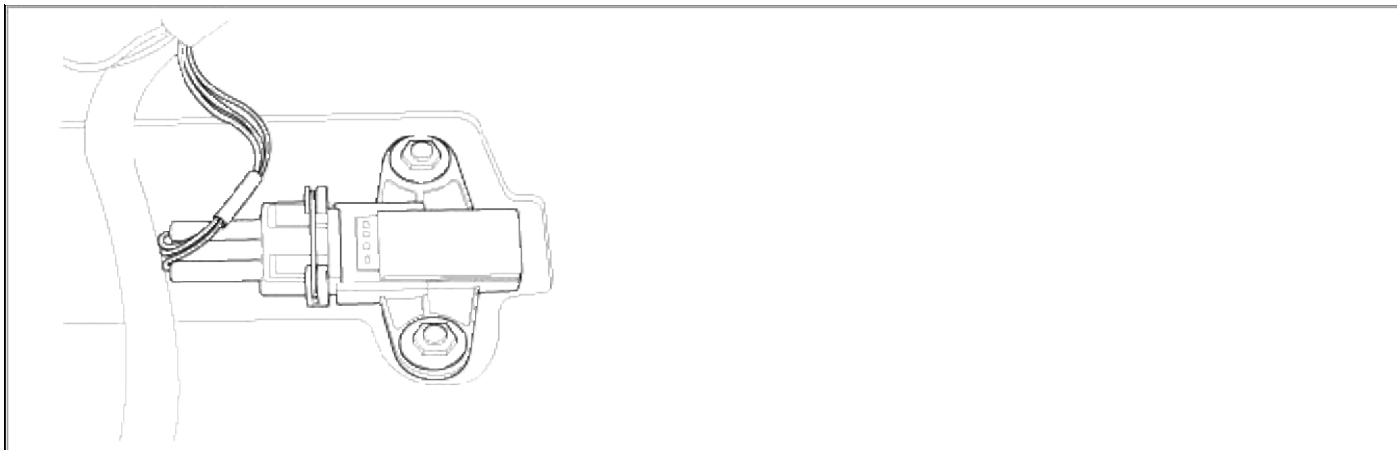
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1274

### COMPONENT LOCATION



### General Description

The 4WD vehicle measures the G-sensor signal to solve for 4WD vehicle unique problems. For example all 4 wheels are locked early on a low-friction road or control response is delayed when road friction coefficients vary. The HECU uses a filtered signal, as a supplementary value, to determine the road friction coefficient. This value is used for the accurate calculations of assumed vehicle speed, or precise division of control starting points.

### DTC Description

The HECU monitors the G-sensor signal continuously, and sets this code if the abnormal G-sensor signal is detected or the difference between the value calculated from vehicle speed deviation and measured value is out of range when the vehicle isn't decelerating (brake switch is OFF).

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of G-Sensor circuit</li> <li>• Faulty G-Sensor</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>• When the voltage of G-sensor signal is <math>&gt; 4.7V</math> or <math>&lt; 0.3V</math> continuously.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>• ABS functions are inhibited, EBD function is allowed and the ABS warning lamps are activated.</li> </ul>	

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".



3. Monitor the "G-sensor" parameter on the Scantool.

Specification : Approx.  $\pm 0.01G$

1.2 CURRENT DATA		
✖ BATTERY VOLTAGE	14.2	V
✖ WHEEL SPD SENSOR-FL	0.0	Km/h
✖ WHEEL SPD SENSOR-FR	0.0	Km/h
✖ WHEEL SPD SENSOR-RL	0.0	Km/h
✖ WHEEL SPD SENSOR-RR	0.0	Km/h
G SENSOR	0.0	G

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Normal Data

4. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in G-sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

#### Terminal and Connector Inspection

- Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Power Circuit Inspection" procedure.

#### Power Circuit Inspection

- Ignition "ON" & Engine "OFF".

2. Measure voltage between terminal "3" of the G-sensor harness connector and chassis ground.

Specification : Approx. B+



3. Is the measured voltage within specifications?

**YES**

Go to "Signal Circuit Inspection" procedure.

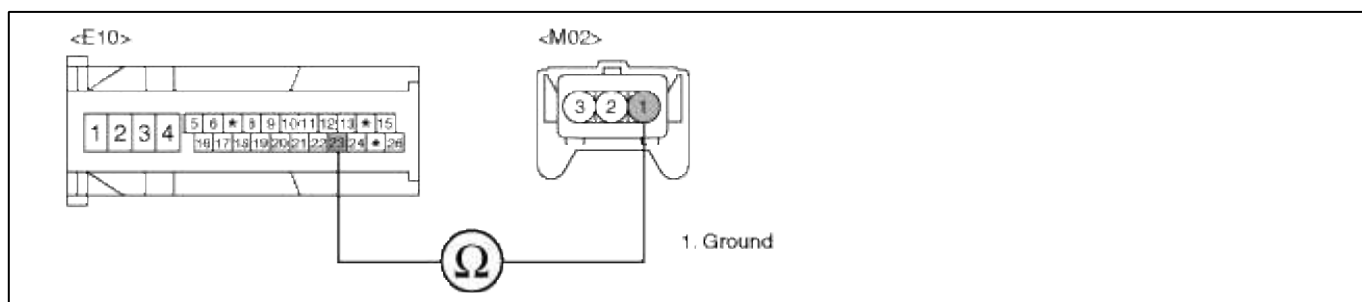
**NO**

Check for open or short in the power harness between terminal "24" of the HECU harness connector and terminal "3" of the G-sensor harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect G-sensor connector.
3. Measure resistance between terminal "1" of the G-sensor harness connector and terminal "23" of the HECU harness connector.

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications?

**YES**

Go to "Signal Circuit inspection" procedure.

**NO**

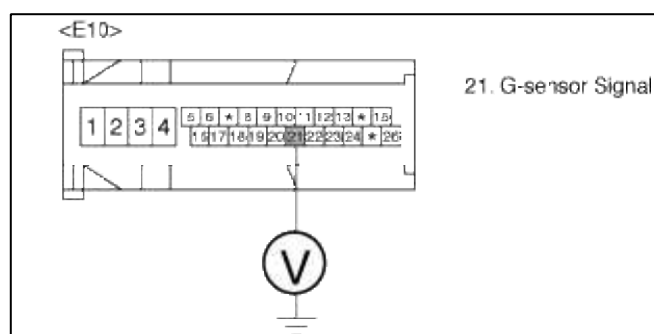
Check for damaged harness and poor connection between terminal "1" of the G-sensor harness connector and terminal "23" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF".

2. Measure voltage between terminal "21" of the HECU harness connector and chassis ground.

Specification : Approx. 2.5V



3. Is the measured voltage within specifications?

**YES**

Fault is intermittent caused by open or short G-sensor and/or faulty G-sensor or was repaired and HECU memory was not cleared. Go to "Component Inspection" procedure.

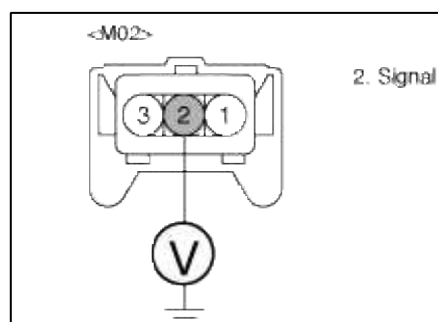
**NO**

Check for open or short in the G-sensor harness between terminal "2" of the G-sensor harness connector and terminal "21" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the G sensor harness connector and chassis ground.

Specification : Approx. 2.5V



3. Is the measured voltage within specifications?

**YES**

Fault is intermittent caused by open or short G-sensor and/or faulty G-sensor or was repaired and HECU memory was not cleared. Go to "Component Inspection" procedure.

**NO**

Substitute with a known good G-sensor and check for proper operation. If problem is corrected, replace G-sensor and then go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information

4. Are any DTCs present?

**YES**

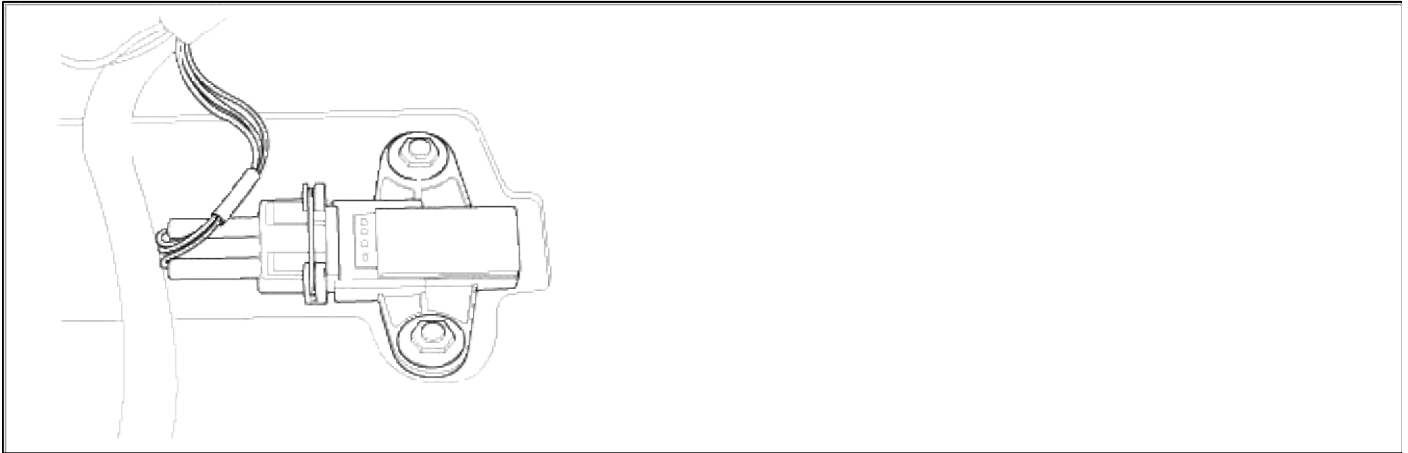
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1275

### COMPONENT LOCATION



### General Description

The 4WD vehicle measures the G-sensor signal to solve for 4WD vehicle unique problems. For example all 4 wheels are locked early on a low-friction road or control response is delayed when road friction coefficients vary. The HECU uses a filtered signal, as a supplementary value, to determine the road friction coefficient. This value is used for the accurate calculations of assumed vehicle speed, or precise division of control starting points.

### DTC Description

The HECU monitors the G-sensor signal continuously, and sets this code if the abnormal G-sensor signal is detected or the difference between measured longitudinal acceleration and longitudinal acceleration by differentiating vehicle speed is out of range when the vehicle isn't decelerating (brake switch is OFF).

### DTC Detecting Condition

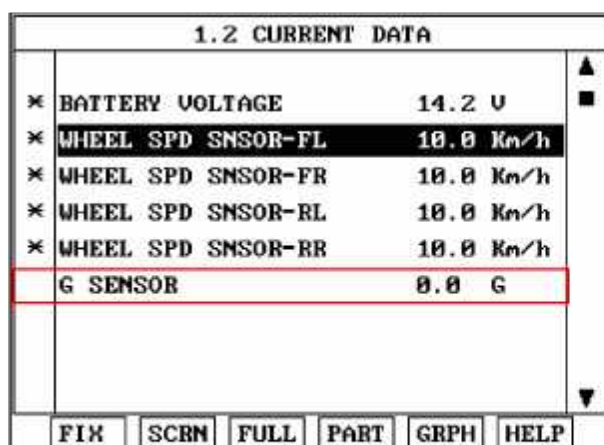
Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	<ul style="list-style-type: none"> <li>• Improper installation of G-Sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Faulty G-Sensor</li> </ul>
Case 1	Monitoring Period	• Continuous (If no under voltage, no BLS, no BLS failure is detected)	
	Enable Conditions	• If the G sensor signal is more than 0.4G for more than 20sec.	
Case 2	Monitoring Period	• Continuous (If no under voltage, no ABS control)	
	Enable Conditions	• the difference between measured longitudinal acceleration and longitudinal acceleration by differentiating vehicle speed exceeds the threshold (Approx. 1.5G). a fault is recognized after 2s.	
Fail Safe		• ABS function is inhibited, EBD function is allowed and the ABS warning lamps are activated.	

#### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more (6.2mph or more) and then accelerate and decelerate the vehicle several times.
4. Monitor the "G-sensor" parameter on the Scantool.

Specification : Below 0.4G (at a uniform speed)

It is a normal condition if the data is changed at accelerating or decelerating vehicle



**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Normal Data

5. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by faulty G-Sensor or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

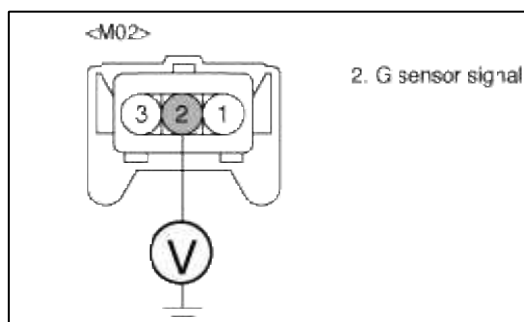
### Component Inspection

1. Check improper installation of G-sensor. If NG, repair as necessary and go to "Verification Of Vehicle Repair" procedure.
2. Check damage of rotor teeth or wheel bearing. If NG, repair as necessary and go to "Verification Of Vehicle Repair" procedure.
3. Ignition "ON" & Engine "OFF".
4. Measure waveform between terminal "2" of the G sensor harness connector and chassis ground by using an oscilloscope.

Specification :

Approx. 2.5V (standstill)

0.3V ~ 4.7V (acceleration or deceleration)



5. Is the measured waveform fixed(standstill) and changing(acceleration or deceleration)?

**YES**

Fault is intermittent caused by improper installation of G-Sensor, abnormal Rotor and wheel bearing, and/or faulty G-sensor or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known good G-sensor and check for proper operation. If problem is corrected, replace G-sensor and go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more (6.2mph or more))
4. Are any DTCs present?

**YES**

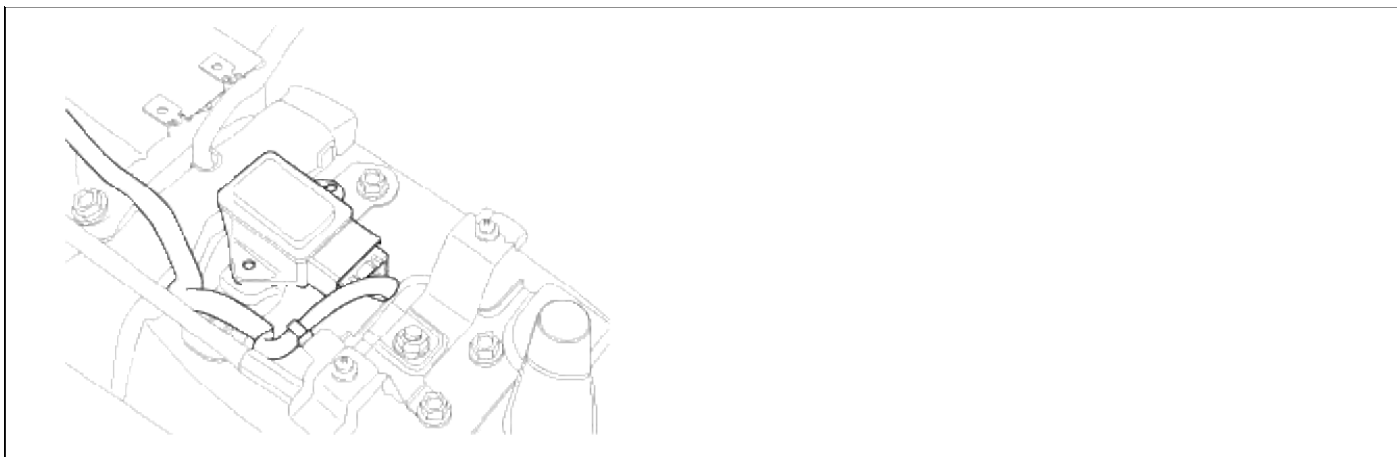
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1282

### COMPONENT LOCATION



### General Description

The yaw-rate and G sensor assembly is installed on the lower floor. The yaw-rate sensor detects acceleration of the vehicle around its vertical axis, while the G sensor detects lateral acceleration of the vehicle. When the vehicle is not moving, the G sensor output is approximately 2.5 V.

### DTC Description

The HECU monitors a signal voltage of either yaw-rate sensor or lateral G sensor to detect open or short to battery or short to ground. A failure is detected if the lateral acceleration sensor or yaw rate sensor signal voltage stays in the fault range longer than 100 ms or the lateral acceleration sensor or yaw rate sensor reference voltage stays in the fault range longer than 200 ms, or the self test form is against specification during self test.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
Case 1	DTC Strategy	<ul style="list-style-type: none"> <li>• Voltage Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative Yaw Rate &amp; Lateral G sensor</li> <li>• Open or short of Yaw Rate &amp; Lateral G sensor</li> <li>• Inoperative HECU</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A line fault is detected if <math>V[LG] &lt; 0.3 \text{ V}</math> or <math>V[LG] &gt; 4.7 \text{ V}</math> for a time <math>t \geq 100 \text{ ms}</math>.</li> <li>• A line fault is detected if <math>V[YAW] &lt; 0.225 \text{ V}</math> OR <math>V[YAW] &gt; 4.774 \text{ V}</math> for a time <math>t \geq 100 \text{ ms}</math>.</li> <li>• A line fault is detected if <math>V[YAW \text{ REFERENCE}] &lt; 2.1 \text{ V}</math> OR <math>V[YAW \text{ REFERENCE}] &gt; 2.9 \text{ V}</math> for a time <math>t \geq 200 \text{ ms}</math>.</li> </ul>	
Case 2	DTC Strategy	<ul style="list-style-type: none"> <li>• Selftest Monitoring</li> </ul>	
	Monitoring Period	<ul style="list-style-type: none"> <li>• Once after power up and no low voltage.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A line fault is detected if <math>0.2 \text{ V} &lt; V[LG] &lt; 0.8 \text{ V}</math> isn't continued for a time <math>t \geq 60 \text{ ms}</math> during POS (POS : power on selftest)</li> </ul>	

## Fail Safe

- Reduced controller function.
- Inhibit the ESC control and ABS/EBD control is available.
- The ESC warning lamps are activated.

## Monitor Scantool Data

1. Connect scantool to Data Link Connector (DLC).
2. Ignition "ON".
3. Monitor the "Yaw rate sensor-lateral & Yaw rate sensor-yaw" parameter on the Scantool.

Specification : Lateral G sensor :  $\pm 0$  G, YAW rate Sensor :  $\pm 0$  deg/s

1.2 CURRENT DATA			
* BATTERY VOLTAGE	14.1	U	
* STOP LAMP SWITCH	OFF		
* STEERING ANGLE SNSR	0	DEG	
* YAW RATE SNSR-LATERAL	0	G	
* YAW RATE SNSR-YAW	0	deg/s	
* PRESSUR SENSOR	0	bar	
ABS WARNING LAMP	ON		
EBD WARNING LAMP	ON		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed Normal data)

4. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

## Terminal &amp; Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Power Circuit Inspection" procedure.

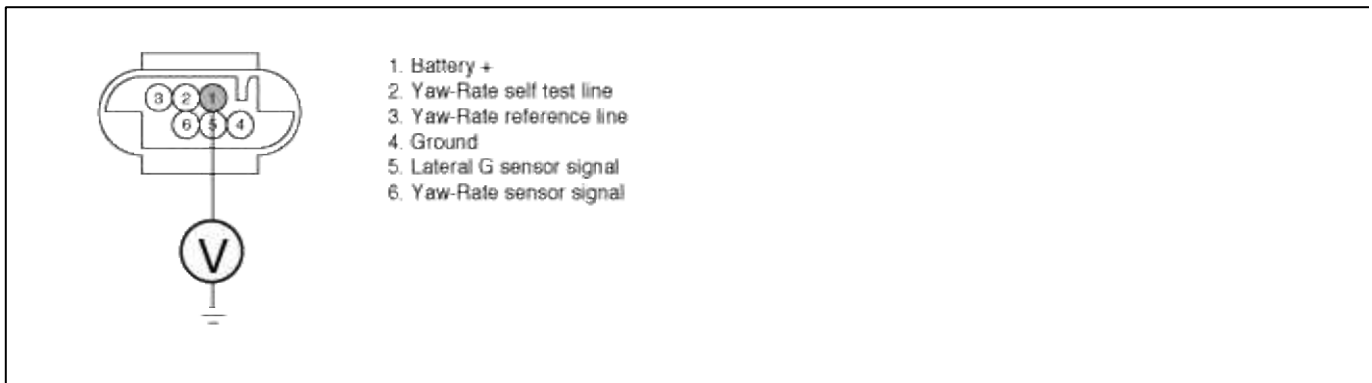
## Power Supply Circuit Inspection

1. Ignition "ON" & Engine "OFF".



2. Measure voltage between terminal "1" of the Yaw Rate & Lateral G sensor harness connector and chassis ground

Specification : Approx. 5 V



3. Is the measured voltage within specifications?

**YES**

Go to "Ground Circuit Inspection" procedure.

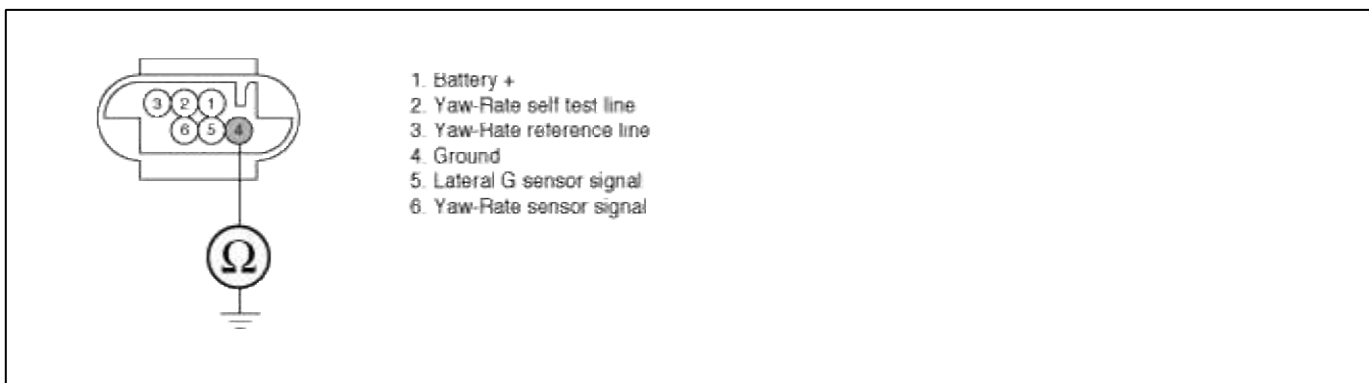
**NO**

Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "1" of the Yaw Rate & Lateral G sensor harness connector and battery +. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect Yaw Rate & Lateral G sensor connector.
3. Measure resistance between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and chassis ground

Specification : Approx. below 1Ω



4. Is the measured resistance within specifications?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and terminal "15" of the HECU harness connector . Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

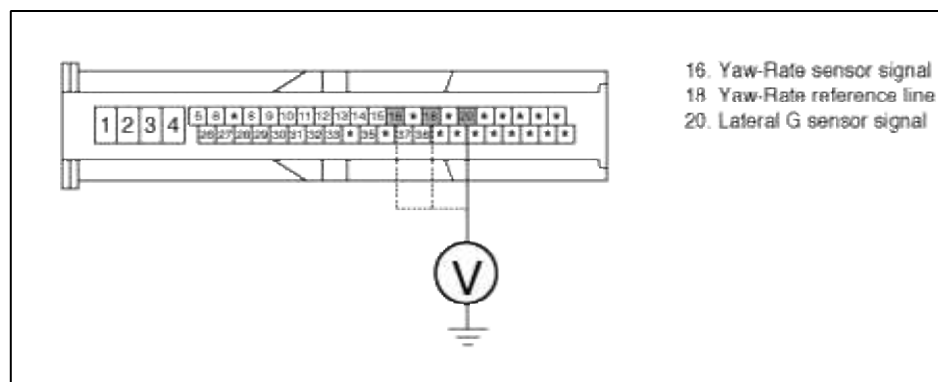
#### Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF".

2. Measure voltage between terminal "16, 18, 20" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5V ( Voltage between terminal "16,20" of the HECU harness connector and chassis ground.)

Specification : Approx. above 2.1V and below 2.9V ( Voltage between terminal "18" of the HECU harness connector and chassis ground.)



3. Is the measured voltage within specifications?

**YES**

Go to "Self Test Circuit Inspection" procedure.

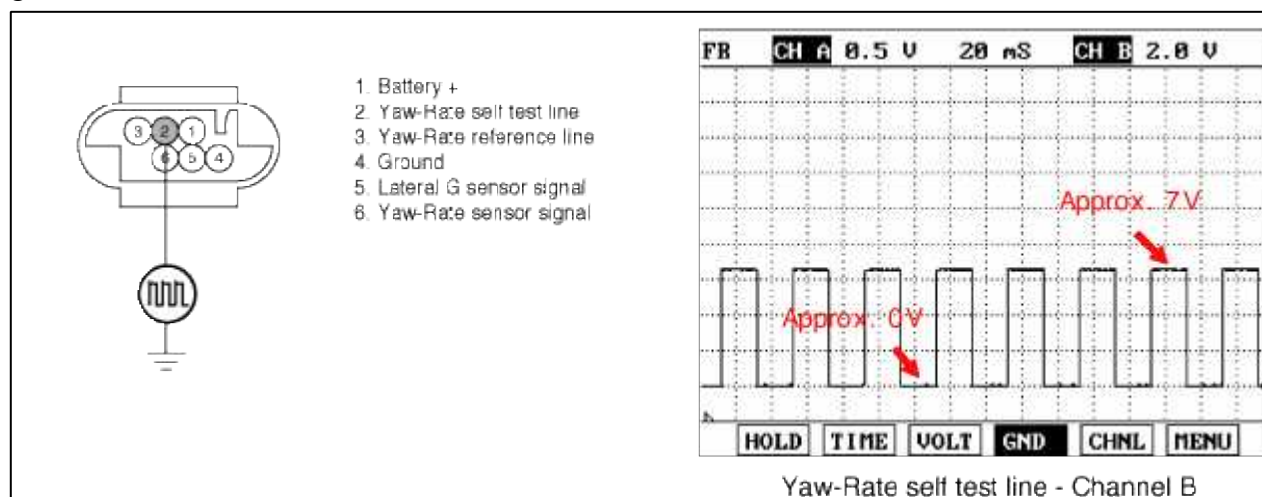
**NO**

Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "6, 3, 5" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 18, 20" of the chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Go to "Component Inspection" procedure.

#### Self Test Circuit Inspection

1. Measure waveform between terminal "2" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.



2. Is the measured waveform within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

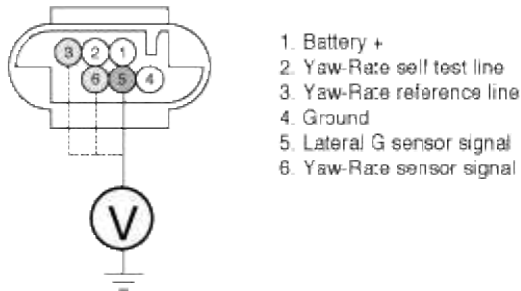
Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "2" of the Yaw Rate & Lateral G sensor harness connector and terminal "37" of the chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "3,5,6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5V ( Voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)

Specification : Approx. above 2.1 V and below 2.9 V ( Voltage between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)



3. Is the measured voltage within specifications?

**YES**

Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

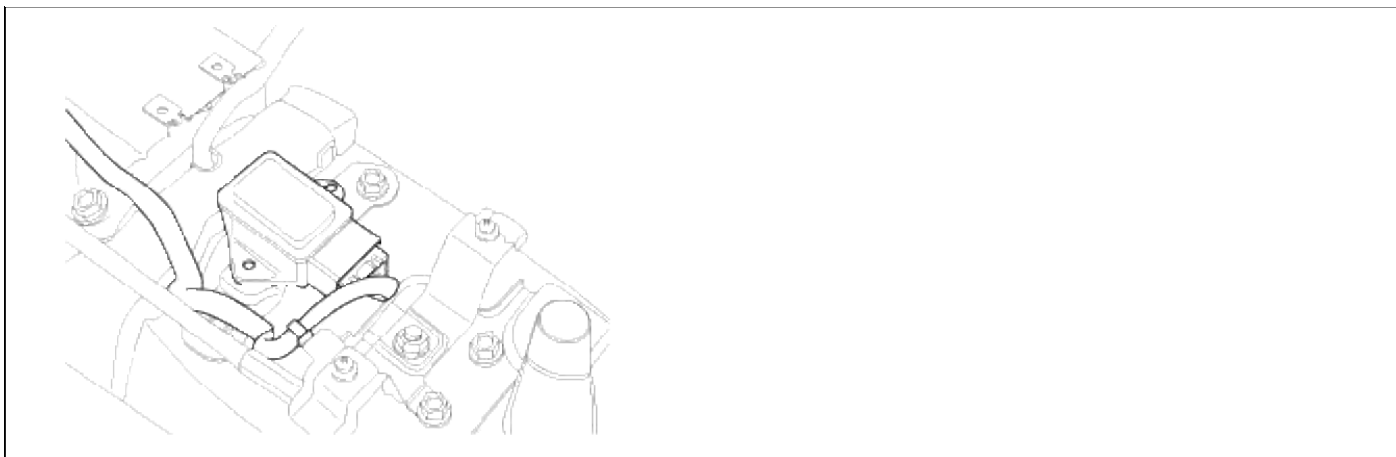
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1283

### COMPONENT LOCATION



### General Description

The yaw-rate and G sensor assembly is installed on the lower floor. The yaw-rate sensor detects acceleration of the vehicle around its vertical axis, while the G sensor detects lateral acceleration of the vehicle. When the vehicle is not moving, the G sensor output is approximately 2.5 V.

### DTC Description

A lateral acceleration reference signal is calculated from the wheel speeds, the steering angle and the yaw rate signals to observe the lateral acceleration sensor signal. The difference between the reference signal and the sensor signal is evaluated for failure detection. A yaw rate reference signal is calculated from the wheel speeds, the steering angle and the lateral acceleration signals to observe the yaw rate sensor signal. The difference between the reference signal and the sensor signal, and the gradient of the measured sensor signal is evaluated for the failure detection. If the difference between estimated value and measured value of the sensor is larger than predefined value for predefined time, the failure is recognized. Plausibility faults (signals received which fall outside of the sensor characteristics) are also recognized.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal Monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during stable driving)</li> </ul>	
		<ul style="list-style-type: none"> <li>By building a reference lateral G from the yaw-rate sensor, wheel speed sensor and the SAS it is possible to test the lateral G Signal on plausibility. If during stable vehicle behavior an lateral G Failure larger than approximately 2.5 m/s<sup>2</sup> occurs, the ESC controller will disregard the lateral G sensor information so that a false ESC intervention is prevented. A fault is recognized after 1.6 s during model validity.</li> </ul>	

Case 1	Enable Conditions	<ul style="list-style-type: none"> <li>The measured and offset compensated yaw rate signal is compared to the reference yaw rate signal calculated from yaw rate sensor, lateral G sensor, SAS and wheel speed sensor. If the measured yaw rate deviates more than 2.5 °/s plus a dynamic threshold from the reference yaw rate during model validity, a failure is recognized after 1.6 s. The dynamic threshold is between 2.5°/s and more than 5°/s. A typical value is 3°/s.</li> <li>- During the possibility to observe the recognition time depends on the amount of failure.</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during driving)</li> </ul>
Case 2	Enable Conditions	<ul style="list-style-type: none"> <li>During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered lateral G value is equivalent to the offset. If the offset value exceeds a threshold of approximately 2.25 m/s<sup>2</sup> an lateral G fault is determined. Failure detection time depends on the driving distance, vehicle speed and on the amount of failed lateral G signal. Within 30 km of symmetrical driving the calculated offset corresponds to the sensor offset.</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (If no under voltage is detected)</li> </ul>
Case 3	Enable Conditions	<ul style="list-style-type: none"> <li>A fault is detected If the lateral G is higher than 15 m/s<sup>2</sup> for more than 800 ms.</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during standstill)</li> </ul>
Case 4	Enable Conditions	<ul style="list-style-type: none"> <li>If the filtered value of  lateral G  is larger than 7 m/s<sup>2</sup> for more than 400 ms a fault is set.</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (dependent on driving situation)</li> </ul>
Case 5	Enable Conditions	<ul style="list-style-type: none"> <li>Standstill compensation : <ul style="list-style-type: none"> <li>- The offset corresponds to the measured and filtered input value. Failure threshold 5.25 °/s.</li> </ul> </li> <li>Fast compensation (during driving if no standstill compensation could be completed): <ul style="list-style-type: none"> <li>- The offset corresponds to the slightly filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, lateral G sensor and wheel speed sensor. Failure threshold is 7.5 °/s.</li> </ul> </li> <li>Long-term ("normal") compensation (during driving after successful standstill or fast offset compensation): <ul style="list-style-type: none"> <li>- The offset corresponds to the strong filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, lateral G sensor and wheel speed sensor. Failure threshold is 7.5 °/s</li> </ul> </li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>After every standstill.</li> </ul>

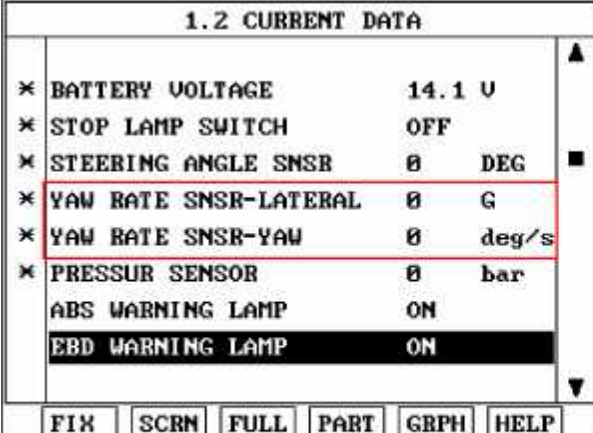
- Inoperative Yaw Rate & Lateral G sensor
- Open or short of Yaw Rate & Lateral G sensor

Case 6	Enable Conditions	<ul style="list-style-type: none"> <li>• Yaw-rate sensor sensitivity is estimated by comparison of the measured yaw rate and the yaw rates calculated from the wheel speed sensor and SAS during cornering. The fault criteria is approx. 25% sensitivity.</li> <li>• The measured yaw rate and the model yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals doesn't fit and forward driving is reconized, a fault is determined. <ul style="list-style-type: none"> <li>- Driving with a yaw rate of e.g. 10 °/s requires a time of 3s and additional time to reach a velocity 20 m/s to recognize forward driving.</li> </ul> </li> </ul>
Case 7	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous (after initialization of the YRS and if no under voltage is detected)</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• The yaw rate sensor BITE logic evaluates the BITE-signal by extraction of the measured yaw rate of the vehicle. The allowed range for the BITE-signal is <math>25\text{ °/s} \pm 7\text{ °/s}</math>. If the BITE-signal is not in the allowed range, a suspected failure bit is set after 200 ms. A failure is set within 400 ms.</li> </ul>
Case 8	Monitoring Period	<ul style="list-style-type: none"> <li>• After YRS-initialization, no under voltage</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Depending on the driving conditions a signal gradient higher than <math>10 \sim 23\text{ °/s} / 40\text{ ms}</math> sets a suspected failure bit after 280 ms, unless a single signal peak is recognized by a peakfilter. A failure is set, if the good check is not settled successfully after 10 s.</li> </ul>
Case 9	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous (except spinning, use of handbrake, unsteady driving conditions or a detected under voltage)</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• During standstill <ul style="list-style-type: none"> <li>- The allowed range of the yaw rate sensor signal is <math>\pm 30\text{ °/s}</math>. Leaving this range for 5 s sets a fault. In case of driving off after the failure was present for longer than 500 ms during standstill, the fault is detected immediately.</li> </ul> </li> <li>• While driving <ul style="list-style-type: none"> <li>- The allowed range of the yaw rate sensor signal is <math>\pm 94.75\text{ °/s}</math> and a suspected failure bit is set, if the signal is out of this range for 500 ms. A fault is set after 1 s.</li> </ul> </li> </ul>
Case10	Monitoring Period	<ul style="list-style-type: none"> <li>• Once after power up and no low voltage.</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• A line fault is detected if <math>0.2\text{V} &lt; \text{VLG} &lt; 0.8\text{V}</math> isn't continued for a time <math>t \geq 60\text{ms}</math> during POS (POS : power on selftest)</li> </ul>
Fail Safe		<ul style="list-style-type: none"> <li>• Reduced controller function.</li> <li>• Inhibit the ESC control and ABS/EBD control is available.</li> <li>• The ESC warning lamps are activated.</li> </ul>

## Monitor Scantool Data

1. Connect scantool to Data Link Connector (DLC).
2. Ignition "ON".
3. Monitor the "Yaw rate sensor-lateral & Yaw rate sensor-yaw" parameter on the Scantool.

Specification : Lateral G sensor :  $\pm 0$  G, YAW rate Sensor :  $\pm 0$  deg/s



* BATTERY VOLTAGE	14.1 U
* STOP LAMP SWITCH	OFF
* STEERING ANGLE SNSR	0 DEG
* YAW RATE SNSR-LATERAL	0 G
* YAW RATE SNSR-YAW	0 deg/s
* PRESSUR SENSOR	0 bar
ABS WARNING LAMP	ON
EBD WARNING LAMP	ON

FIX    SCRN    FULL    PART    GRPH    HELP

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed Normal data)

4. Is parameter displayed within specifications?

**YES**

Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

## Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Power Circuit Inspection" procedure.

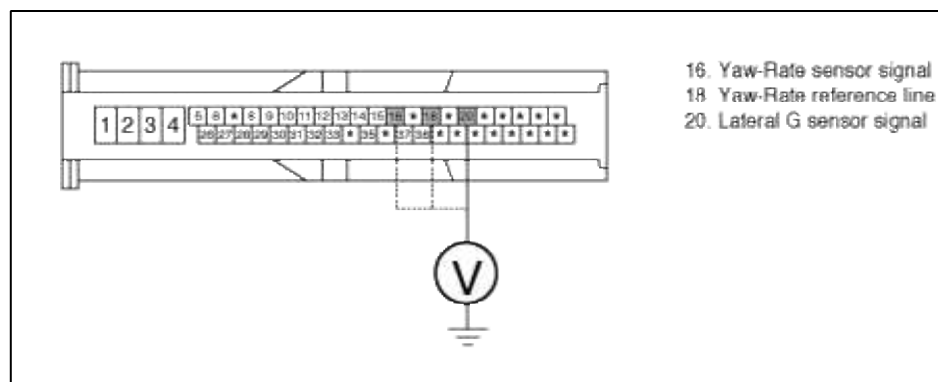
## Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF".

2. Measure voltage between terminal "16,18,20" of the HECU harness connector and chassis ground.

Specification : Approx. 2.5 V ( Voltage between terminal "16, 20" of the HECU harness connector and chassis ground.) If the voltage of the yaw & lateral G sensor is changed within normal voltage range (approx. 0.1 ~ 4.9 V) during shaking it, it is in normal condition.

Specification : Approx. above 2.1 V and below 2.9 V ( Voltage between terminal "18" of the HECU harness connector and chassis ground.)



3. Is the measured voltage within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "6, 3, 5" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 18, 20" of the HECU harness connector . Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Go to "Component Inspection" procedure.

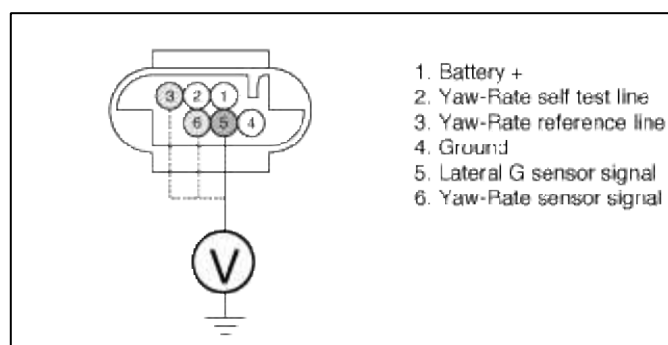
### Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "3, 5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5V ( Voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)

If the voltage of the yaw & lateral G sensor is changed within normal voltage range (approx. 0.1~4.9V) during shaking it, it is in normal condition.

Specification : Approx. above 2.1V and below 2.9V ( Voltage between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)





3. Is the measured voltage within specifications?

**YES**

Fault is intermittent caused by poor connection in Yaw Rate amp; Lateral G sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good Yaw Rate amp; Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate amp; Lateral G sensor and then go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

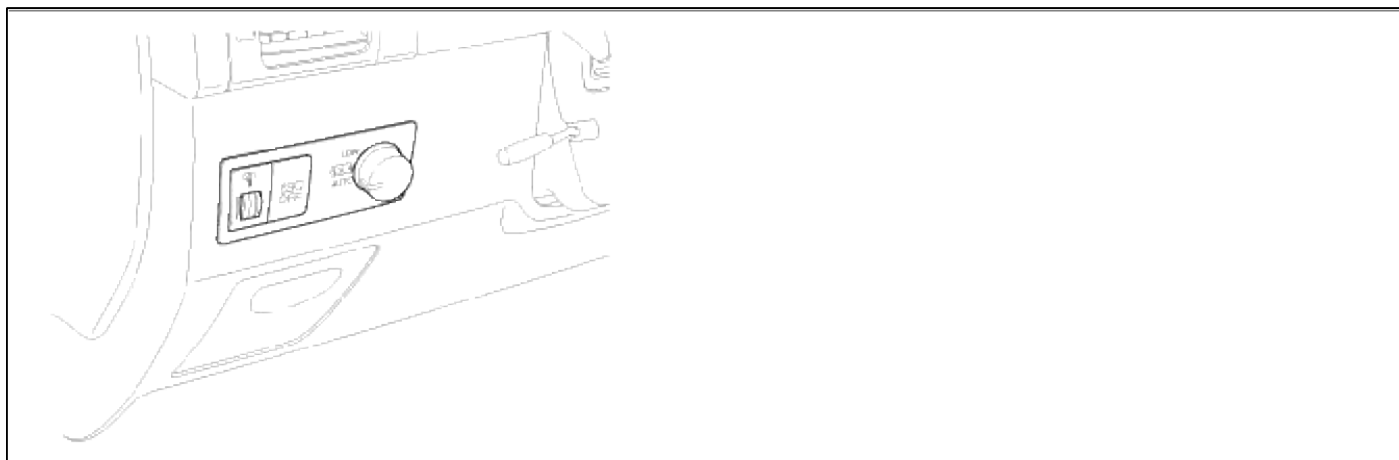
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1503

#### COMPONENT LOCATION



#### General Description

Driver can inhibit the ESC control by ESC switch. When switch signal send into HECU, ESC warning lamp go ON and ESC control is stopped and if next switch signal is inputted again, ESC control is ready. This function is used for sporty driving or vehicle inspection.

#### DTC Description

Trouble code is set when the condition that the level of ESC switch is high is continued for 60 sec. When the ESC switch failure is set there is no signal in the warning lamp and HECU inhibit the ESC control and allow the ABS/EBD control.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Short circuit monitoring	• Open or short ESC switch
Monitoring Period	• Continuous	
Enable Conditions	• When the ESC switch is ON for 60 sec.	
Fail Safe	• Inhibit the ESC control and allow the ABS/EBD control. • The ESC warning lamps are activated.	

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Press the ESC SWITCH.
4. Monitor the "TCS/ESC SWITCH" parameter on the scantool.

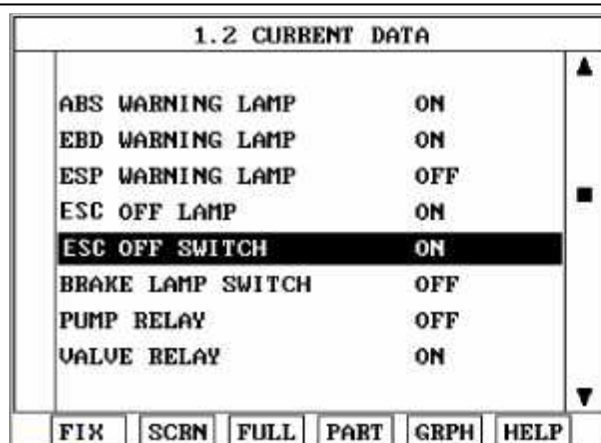


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF". Normal data

5. Whenever the switch is pushed up/down, is the esc off switch's scantool data changed ON/OFF?

**YES**

Fault is intermittent caused by poor connection in esc switch line or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

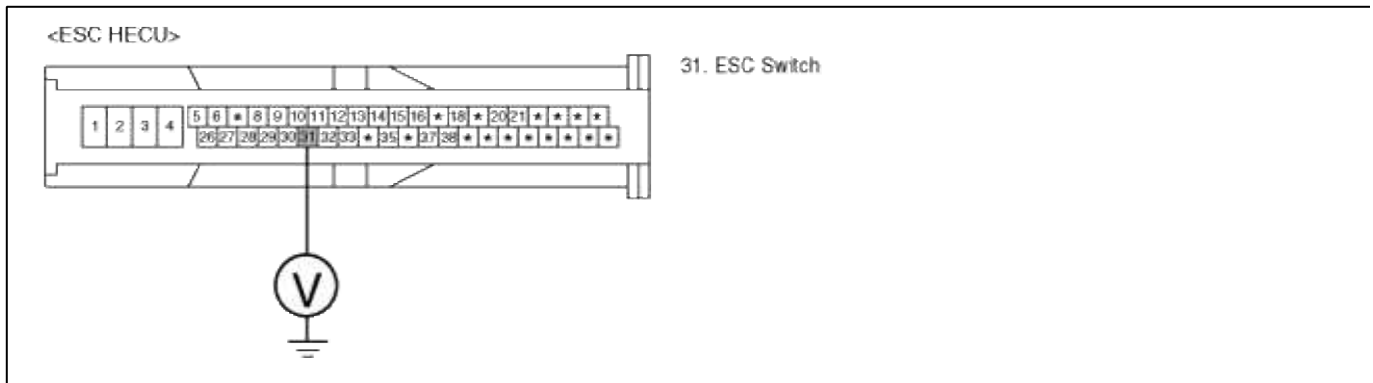
**NO**

Go to "Signal Circuit Inspection" procedure.

#### SIGNAL Circuit Inspection

1. Ignition "ON" & Engine "OFF" & ESC Switch"ON".
2. Measure voltage between terminal "31" of the HECU harness connector and chassis ground.

Specification : Approx B+



3. Is the measured voltage within specifications?

**YES**

Go to "Component Inspection" Procedure.

**NO**

Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "31" of the HECU harness connector . Check for open or blown 10 A fuse referring to "Circuit Diagram" . Repair as necessary and then go to "Verification Of vehicle Repair" procedure.

If OK, Go to "Component Inspection" Procedure.

#### Component Inspection

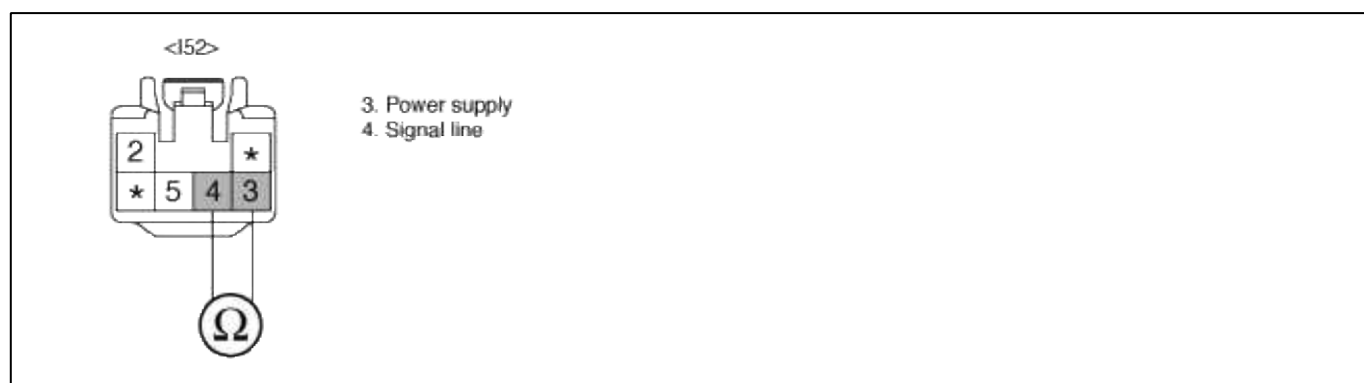
1. Ignition "ON".
2. Disconnect ESC switch connector.
3. Press the ESC switch.

4. Measure resistance between terminal "3, 4" of the ESC switch component connector.

Specification :

Approx. below 1  $\Omega$  - ESC switch is depressed.

Approx.  $\infty$   $\Omega$  - ESC switch is not depressed.



5. Is the measured resistance within specifications?

**YES**

Fault is intermittent caused by poor connection in ESC switch line or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good ESC switch and check for proper operation. If problem is corrected, replace ESC switch and then go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

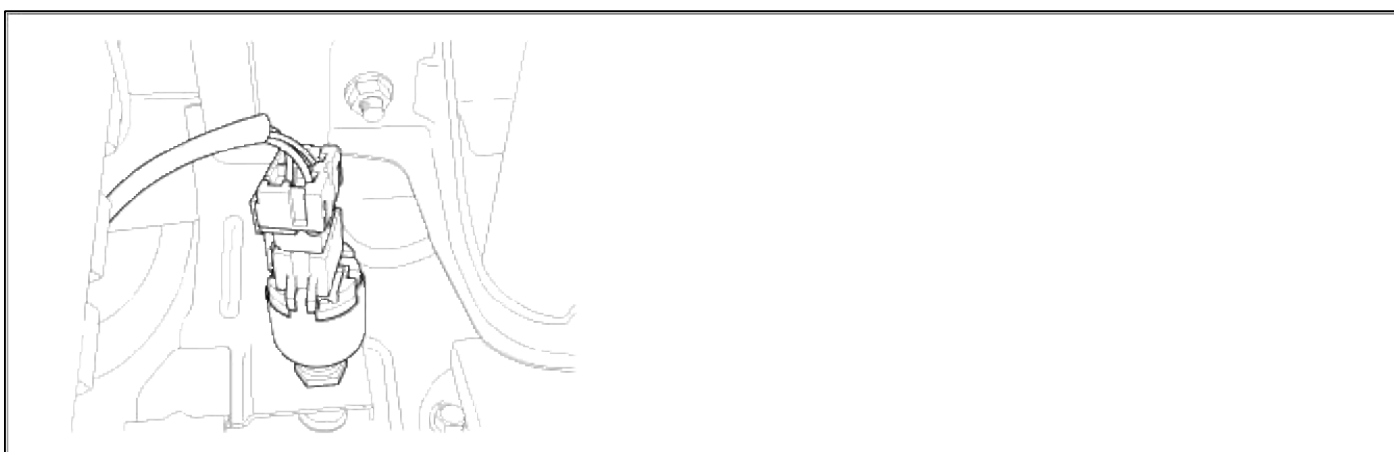
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

#### Brake System > Troubleshooting > C1513

#### COMPONENT LOCATION



### General Description

The brake light switch indicates brake pedal status to the ABS control unit. The brake light switch which is dual switch type send brake light signal to HECU. The switch is turned on when brake is depressed. The brake light switch runs to battery voltage when brake depressed. The brake light switch doesn't run to battery voltage when brake is not depressed.

### DTC Description

The brake light signal is a reference to judge driver's intention for braking and The HECU checks open or short circuit of brake light switch for normal ABS/ESC control. If an error exists, warning lamp will be turned ON.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Open circuit in brake switch line</li> <li>Inoperative brake light switch</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only no under voltage is not detected)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If the BLS-signals is high for 60 s at following condition.               <ol style="list-style-type: none"> <li>the gas pedal is stepped</li> <li>vehicle speed &gt; 10.8km/h(6.7mph)</li> <li>offset compensated pressure &lt; 5 bar</li> <li>no control is active</li> </ol> </li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only normal voltage)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>For redundancy reasons an additional BLSpVor-signal is created by the pressure sensor signal. If the pressure sensor is compensated, the threshold for generating the BLSpVor signal is 10 bar. If the pressure sensor is not compensated, the threshold is increased by 25 bar. If this signal is set without any hardware-BLS-signals being set for at least 1s.</li> <li>If the pressure signal is higher than 80bar and not both of the hardware-BLS are set, a fault is stored after 1s.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Inhibit the ESC control and ABS/EBD control is available.</li> <li>The ESC warning lamps are activated.</li> </ul>	

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON"
3. Press the brake pedal.

4. Monitor the "BRAKE SWITCH" parameter on the scantool.

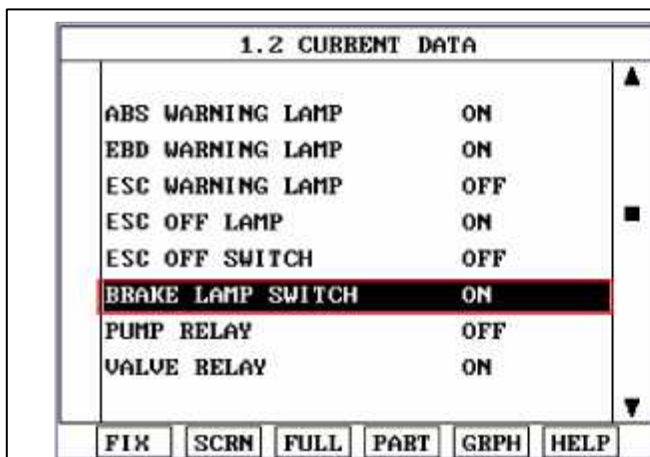


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF" Normal data

5. Whenever brake pedal is pushed down, is the brake switch's scantool data changed ON/OFF?

**YES**

Fault is intermittent caused by poor connection in brake switch line or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

#### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused poor harness(es) and terminals condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

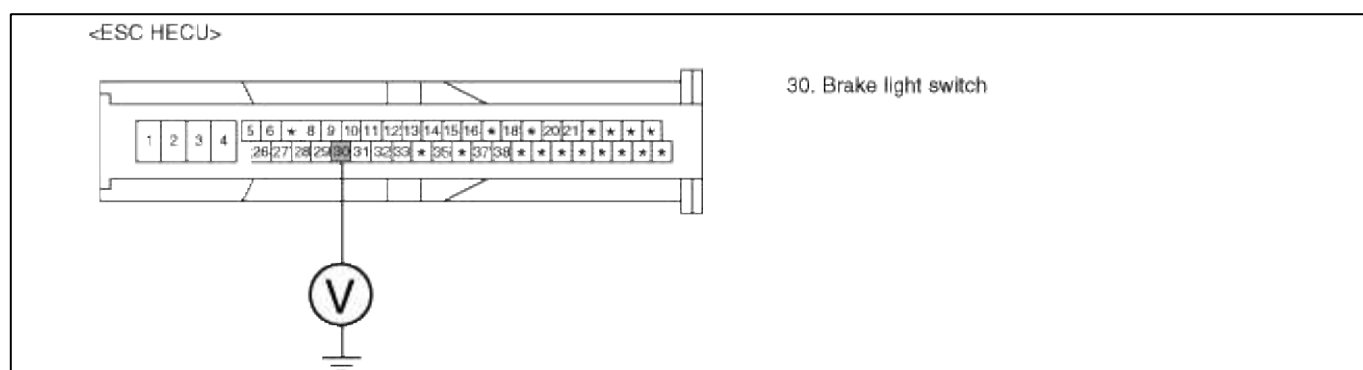
Go to "Power Circuit Inspection" procedure.

#### Signal circuit inspection (brake pedal isn't depressed)

1. Ignition "ON" & Engine "OFF".
2. Don't press the brake pedal.

3. Measure voltage between the terminal "30" of the HECU harness connector and chassis ground.

Specification : Brake Light Switch - Approx. 0 V



4. Is the measured voltage within specifications?

**YES**

Fault is intermittent caused by a short to power within circuit. Thoroughly check connectors for chafing to other wires and circuits. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

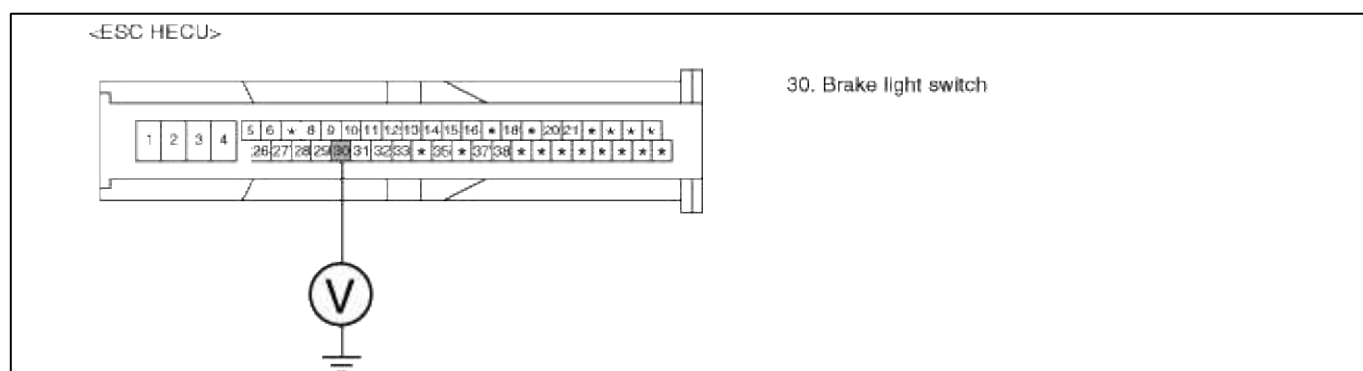
Check for open or blown 20A STOP, 7.5A SNSR fuse referring to "Circuit Diagram". Check for open or short to battery between the battery terminal(+) and the terminal "30" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check circuit for a short to power. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Signal circuit inspection (brake pedal is depressed)

1. Ignition "ON" & Engine "OFF".
2. Press the brake pedal.
3. Measure voltage between the terminal "30" of the HECU harness connector and chassis ground.

Specification : Brake Light Switch - Approx. B+



4. Is the measured voltage within specifications?

**YES**

Fault is intermittent caused by open or short harness in brake light switch, faulty brake light switch or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for open or short to ground between the battery terminal(+) and the terminal "30" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

If OK, Go to "Component Inspection" Procedure.

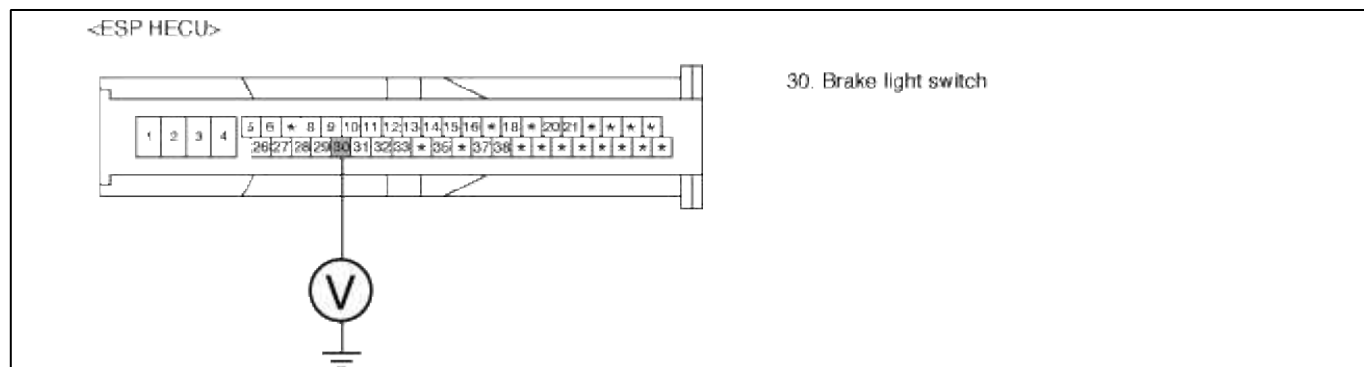
## Component Inspection

1. Ignition "OFF".
2. Disconnect brake switch connector.
3. Measure resistance between the terminal "1", "2" of the brake switch.

---

Resistance between the terminal "1,2" of the brake switch -  $\infty\Omega$  (when the plunger is pushed down),  $0\Omega$  (when the plunger isn't pushed down).

---



4. Is the measured voltage within specifications?

**YES**

Fault is intermittent caused by open or short harness in brake light switch, faulty brake light switch or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good brake lamp switch and check for proper operation. If problem is corrected, replace brake light switch and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1604

### COMPONENT LOCATION





### General Description

The HECU is composed of an ECU (Electronic Control Unit) and a HCU (Hydraulic Control Unit). The HCU is composed of a source of hydraulic pressure and modulator valve block. Increase and decrease of hydraulic pressure is operated by electronic motor. According to a detected signal by wheel speed sensor, the hydraulic pressure which is needed for control is supplied by pump. The HCU's function, which is composed of an accumulator, return pump, solenoid valve, is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper by operating return pump according to HECU control signal while ABS control is active.

### DTC Description

The HECU monitors the operation of the IC components such as memory, register, A/D converter and so on. The ECU sets this code when the EEPROM data read by the master processor is different than prior data written, or when the master/slave processor detects abnormal operation in RAM, Status Register, Interrupt, Timer, A/D converter or cycle time.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Internal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If internal control unit failures of the master/slave processor or peripheral integrated circuits are detected.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Directly after ignition on, during reading of EEPROM-values</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Failure is set if checksum is not correct or PSW-EEPROM-Handler reported unknown failure during EEPROM-value reading.</li> <li>If EEPROM reading sequence takes longer than 3 s, a failure is set.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>The ABS/EBD/ESC functions are inhibited.</li> <li>The ABS/EBD/ESC warning lamps are activated.</li> </ul>	

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

☐ **YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

☐ **NO**

Go to "Component Inspection" procedure.

#### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

☐ **YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

☐ **NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

☐ **YES**

Go to the applicable troubleshooting procedure.

☐ **NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C1605

#### COMPONENT LOCATION



### General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

### DTC Description

The HECU checks the CAN control module for normal TCS control, and sets this code if CAN control module malfunction is detected.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN control module monitoring	• Inoperative HECU
Monitoring Period	• Immediate during start up	
Enable Conditions	• Faults are detected immediately if the initialization software can't have write access to the configuration registers of the CAN-controller module.	
Fail Safe	• Inhibit the ESC control and ABS/EBD control is available.	

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1611

### COMPONENT LOCATION



### General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

### DTC Description

The HECU checks the CAN communication lines for normal ESC control, and sets this code if a PCM(ECM) message is not received within predefined time.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN message monitoring	<ul style="list-style-type: none"> <li>• Inoperative PCM(ECM)</li> <li>• Bad connection of PCM, open or short circuit in PCM line.</li> </ul>
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if PCM(ECM) message was not received or EMS CAN message is abnormal on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESC control and ABS/EBD control is available.	

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present?

**YES**

Substitute with a known-good AFS(air flow sensor) and TPS(throttle valve sensor),and check for proper operation. If problem is corrected, replace AFS and TPS,and then go to "Verification Of Vehicle Repair" procedure.

Substitute with a known-good PCM(ECM) and check for proper operation. If problem is corrected, replace PCM(ECM) and then go to "Verification Of Vehicle Repair" procedure.If NG, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1612

### COMPONENT LOCATION



### General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

### DTC Description

The HECU checks the CAN communication lines for normal TCS control, and sets this code if a PCM(TCM) message is not received within predefined time.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN control module monitoring	<ul style="list-style-type: none"> <li>• Inoperative PCM(TCM)</li> <li>• Bad connection of PCM, open or short circuit in PCM line.</li> </ul>
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if PCM(TCM) message was not received or TCU CAN message is abnormal on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESC control and ABS/EBD control is available.	

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present?

**YES**

Substitute with a known-good PCM(ECM) and check for proper operation. If problem is corrected, replace PCM(ECM) and then go to "Verification Of Vehicle Repair" procedure.If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1616

### COMPONENT LOCATION



### General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

### DTC Description

The HECU checks the CAN communication lines for normal TCS control, and sets this code if re-initialization is tried for 15 times in sequence without success.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Open or short monitoring	• Open or short circuit in CAN line
Monitoring Period	• Continuous	
Enable Conditions	• A CAN BUS off fault is established if re-initialization is tried for 15 times in sequence without success.	
Fail Safe	• Inhibit the ESC control and ABS/EBD control is available. Meanwhile, stop checking the ESC switch failure under the ESC control.	

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

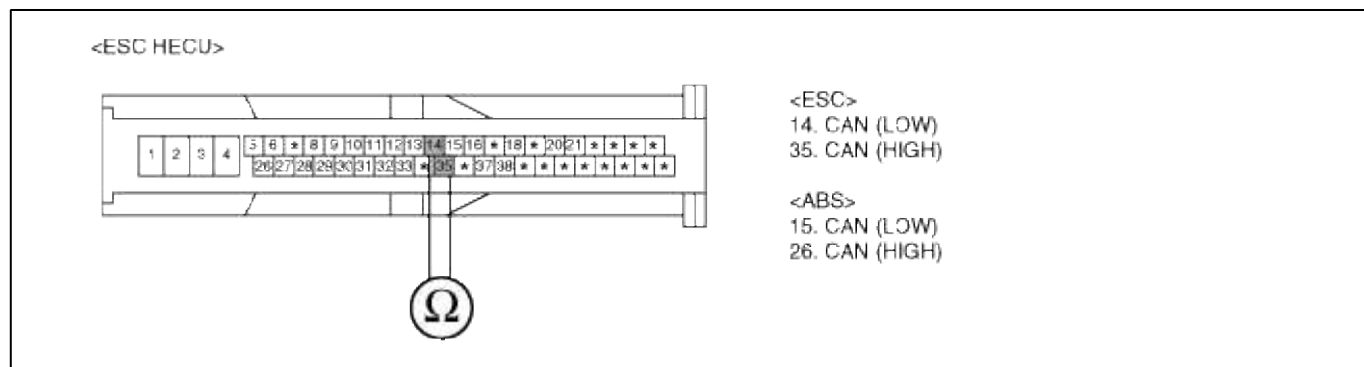
Go to "Signal Circuit Inspection" procedure.



## Signal Circuit Inspection

1. Ignition "OFF".
2. Disconnect the HECU harness connector.
3. Measure resistance between terminal "14" of the HECU harness connector and terminal "35" of the HECU harness connector.

Specification : Approx. 60Ω



4. Is the measured resistance within specifications?

**YES**

Fault is intermittent caused by open or short in CAN signal harness or was repaired and HECU memory was not cleared. go to "CAN Bus Short (to ground) Inspection" procedure.

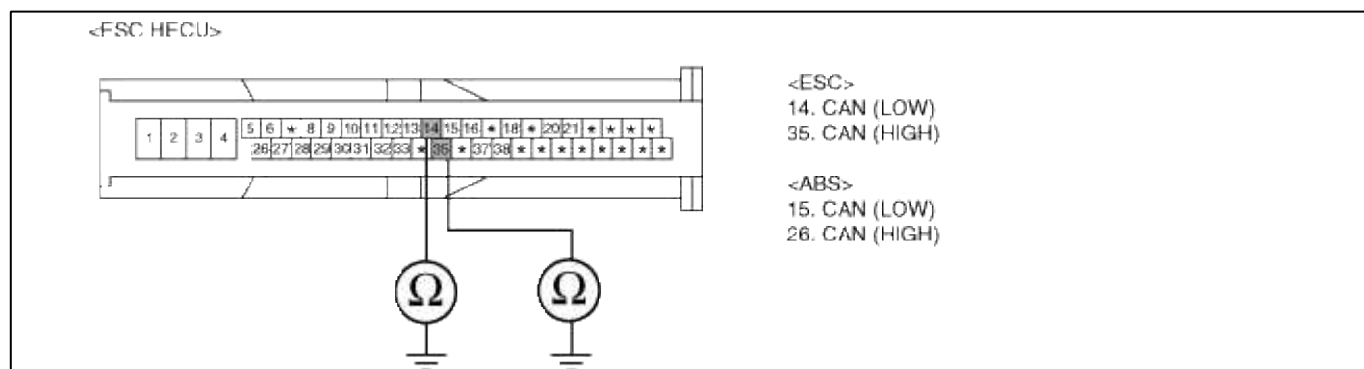
**NO**

Check for open or short in CAN signal harness between terminal "14" of the HECU harness connector and terminal "35" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## CAN Bus Short (to ground) Inspection

1. Ignition "OFF".
2. Disconnect the HECU harness connector.
3. Measure resistance between terminal "14, 35" of the HECU harness connector and chassis ground.

Specification : Approx. ∞ Ω



4. Is the measured resistance within specifications?

**YES**

Go to "CAN Bus Short (to battery) Inspection" procedure.

**NO**

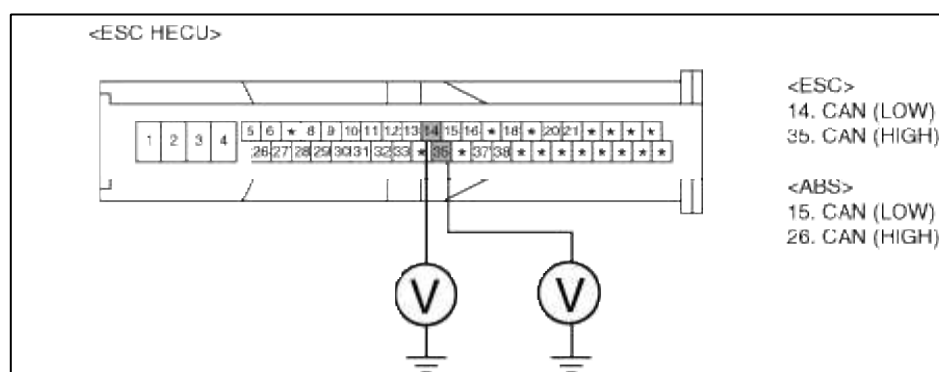
Check for short to ground in CAN HIGH signal harness in case of abnormal resistance measured between terminal "35" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

Check for short to ground in CAN LOW signal harness in case of abnormal resistance measured between terminal "14" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### CAN Bus Short (to battery) Inspection

1. Ignition "OFF".
2. Disconnect the HECU harness connector.
3. Measure voltage between terminal "14, 35" of the HECU harness connector and chassis ground.

Specification : Below. 0.2 V



4. Is the measured voltage within specifications?

**YES**

Go to "CAN Bus Short (between HIGH and LOW) Inspection" procedure.

**NO**

Check for short to battery in CAN HIGH signal harness in case of abnormal resistance measured between terminal "14" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

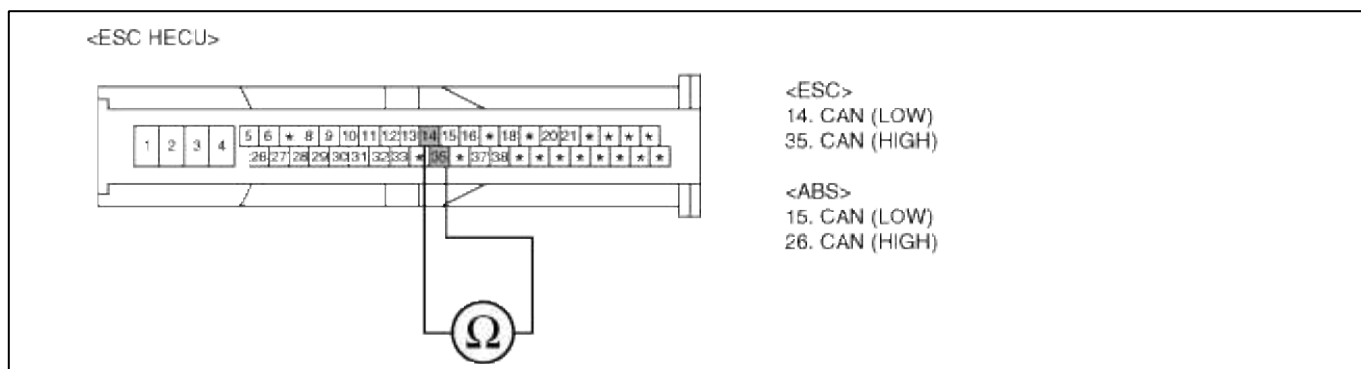
Check for short to battery in CAN LOW signal harness in case of abnormal resistance measured between terminal "35" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### CAN Bus Short (between HIGH and LOW) Inspection

1. Ignition "OFF".
2. Disconnect all the connector related to CAN such as HECU, PCU, EPS, ECS harness connector.

3. Measure resistance between terminal "14, 35" of the HECU harness.

Specification : Approx. 120  $\Omega$



4. Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short in CAN signal harness between terminal "14" of the HECU harness connector and terminal "35" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

#### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

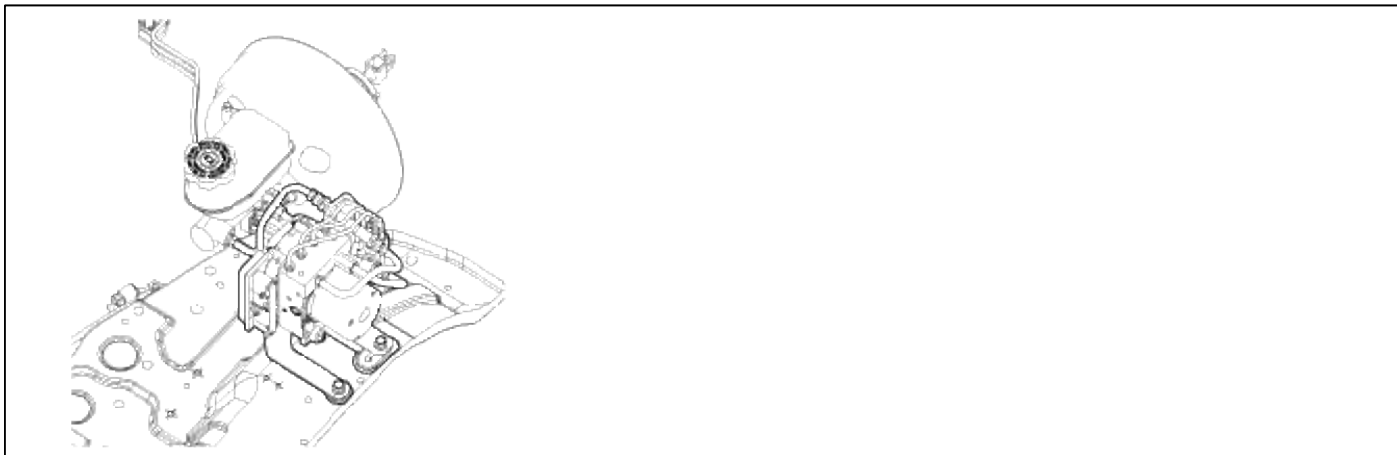
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.



### General Description

The Steering angle sensor(SAS) is joined to the multi function switch and uses a CAN communication. The SAS is used to determine turning direction and speed of the steering wheel. The HECU uses the signals from the SAS when performing ESC-related calculations.

### DTC Description

The HECU checks the CAN communication lines for normal ESC control, and sets this code if a SAS message is not received within predefined time.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN message monitoring	<ul style="list-style-type: none"> <li>• Inoperative SAS</li> <li>• Open circuit in SAS line</li> <li>• Bad connection of SAS</li> </ul>
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if SAS message was not received on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESC control and ABS/EBD control is available.	

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

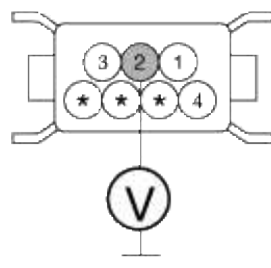
Go to "Power Circuit Inspection" procedure.

### Power Supply Circuit Inspection

1. Ignition "ON".

2. Measure voltage between terminal "2" of the steering angle sensor harness connector and chassis ground.

Specification : Approx. B+



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

3. Is the measured voltage within specifications?

**YES**

Go to "Ground Circuit Inspection" procedure.

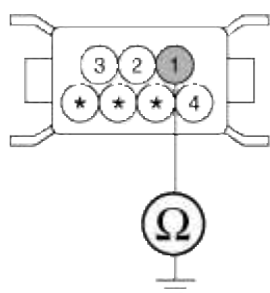
**NO**

Check for damaged harness and poor connection between the battery terminal(+) and terminal "2" of the steering angle sensor harness connector. Check for open or blown 10 A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect SAS connector.
3. Measure resistance between terminal "1" of the steering angle sensor harness connector and chassis ground.

Specification : Approx. below 1  $\Omega$



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

4. Is the measured resistance within specifications?

**YES**

Go to "CAN Circuit Inspection" procedure.

**NO**

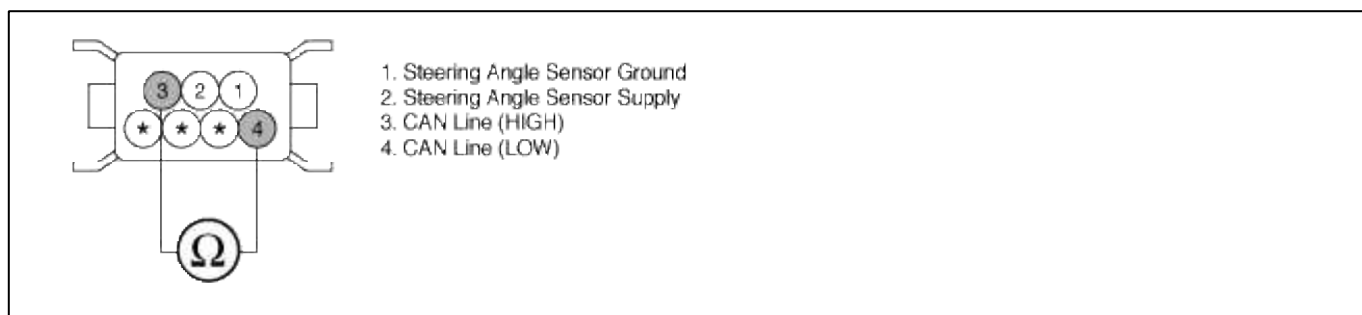
Check for damaged harness and poor connection between terminal "1" of the steering angle sensor harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### CAN Circuit Inspection

1. Ignition "OFF".
2. Disconnect SAS connector.

3. Measure resistance between terminal "3, 4" of the steering angle sensor harness connector.

Specification : Approx. 60  $\Omega$



4. Is the measured resistance within specifications?

**YES**

Go to "CAN Bus Short (to ground) Inspection" procedure.

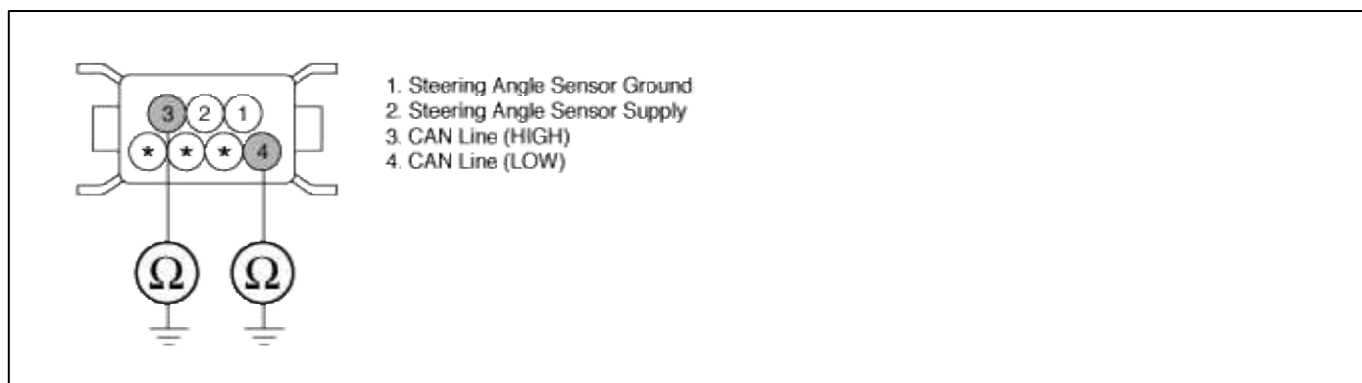
**NO**

Check for damaged harness and poor connection between terminal "3, 4" of the steering angle sensor harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

CAN Bus Short (to ground) Inspection

1. Ignition "OFF".
2. Disconnect the HECU harness connector.
3. Measure resistance between terminal "3, 4" of the HECU harness connector and chassis ground.

Specification : Approx.  $\infty \Omega$



4. Is the measured resistance within specifications?

**YES**

Go to "CAN Bus Short (between HIGH and LOW) Inspection" procedure.

**NO**

Check for short to ground in CAN HIGH signal harness in case of abnormal resistance measured between terminal "3" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

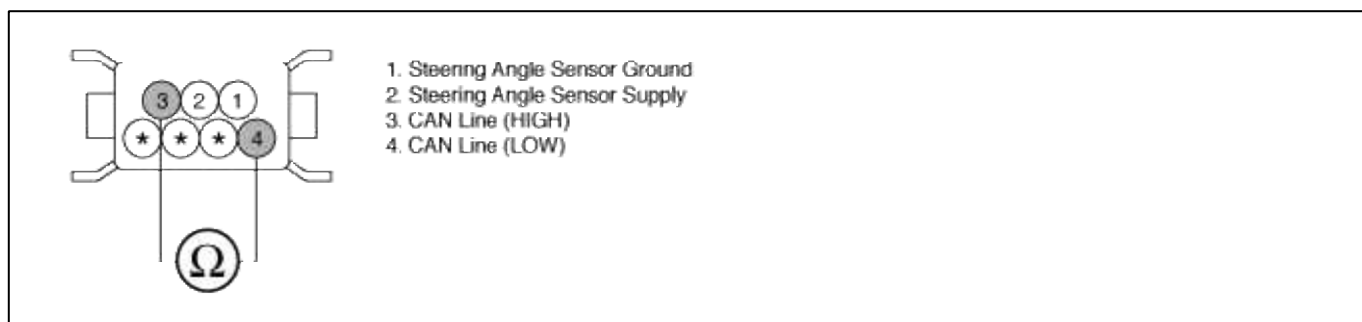
Check for short to ground in CAN LOW signal harness in case of abnormal resistance measured between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

CAN Bus Short (between HIGH and LOW) Inspection

1. Ignition "OFF".
2. Disconnect all the connector related to CAN such as HECU, PCU, EPS, ECS harness connector.

3. Measure resistance between terminal "3, 4" of the HECU harness.

Specification : Approx. 120  $\Omega$



4. Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short in CAN signal harness between terminal "3" of the HECU harness connector and terminal "4" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, retrieve and record all DTC's and refer to the appropriate pages. When completed, clear the DTC(s).
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

- (1) Substitute with a known-good steering angle sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification Of Vehicle Repair" procedure.
- (2) Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by poor connection in steering angle sensor harness or faulty steering angle sensor. Go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

**Brake System > Troubleshooting > C1625****COMPONENT LOCATION****General Description**

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

**DTC Description**

The HECU checks the CAN communication lines for normal ESC control, and sets this code if a CAN message is not transmitted within predefined time.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN message monitoring	• Inoperative HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if CAN message was not transmitted on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESC control and ABS/EBD control is available.	

**Terminal and Connector Inspection**

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.



## 3. Has a problem been found?

**YES** 

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO** 

Go to "Component Inspection" procedure.

## Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES** 

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO** 

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES** 

Go to the applicable troubleshooting procedure.

**NO** 

System performing to specification at this time.

**Brake System > Troubleshooting > C1626**

## COMPONENT LOCATION



## General Description

The ESC is a system to stabilize a car when under steering or over steering in an emergency by supplying appropriate wheel braking pressure according to signal of Yaw, G-sensor, SAS, WSS, and pressure sensor. ESC system helps to avoid an accident.

#### DTC Description

Under normal conditions, the inlet valves of all four wheels are not closed during control for longer than 1.28s or If the controller requests pressure-hold or pressure-decrease for longer than 1.28s, a fault is detected. The ABS/ESC warning lamp is turned ON and the EBD warning lamp is turned OFF.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal monitoring	• Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	<ul style="list-style-type: none"> <li>• If the controller requests pressure-hold or pressure-decrease for longer than 1.28s, a fault is stored.</li> <li>• Under normal condition, the inlet valves of all four wheels are not closed during control for longer than 1.28s.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>• The ABS/ESC functions are inhibited, allow the EBD control.</li> <li>• The ABS/ESC warning lamps are activated.</li> </ul>	

#### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

**Brake System > Troubleshooting > C1627****COMPONENT LOCATION****General Description**

The HECU interchanges requirement data with the 4WD ECU through CAN bus line for normal ABS control. For example the HECU sends a control inhibition signal to 4WD ECU for normal ABS control in case of the ABS and 4WD control requested at the same time such as wheel speed difference between front and rear wheel generated due to wheel slip.

**DTC Description**

The HECU checks absence of the 4WD message from the 4WD ECU for normal ABS control, and sets this code if an 4WD ECU message is not received within predefined time. The HECU checks the presence and specific contents of the 4WD1 message from the 4WD ECU, and sets this code if there is an error in 4WD ECU message1.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>CAN message monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Faulty 4WD ECU</li> <li>Bad connection of 4WD ECU, open or short circuit in 4WD ECU line.</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>Faults are detected if 4WD message was not received on time by the CAN controller of HECU.</li> <li>If the 4WD ECU detected an following error and informed the HECU about it via CAN, a fault is determined.               <ul style="list-style-type: none"> <li>4WD1 message timeout was detected by HECU</li> <li>4WD1 data length code error was detected</li> <li>a failure of the 4WD ECU shift motor or encoder was detected</li> <li>a 4WD magnetic clutch failure was detected</li> <li>the 4WD ECU does not receive the TCS4 message any more</li> <li>the 4WD max cardan shaft torque contains faulty torque information</li> </ul> </li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Inhibit the ABS/ESC control and allow the EBD control.</li> <li>ABS/ESC warning lamps are activated.</li> </ul>	

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, retrieve and record all DTC's and refer to the appropriate pages. When completed, clear the DTC(s).
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

**YES**

Refer to the 4WD diagnostic part to find a cause of fault. If there is no problem in 4WD, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

The ECU mounted in the wrong type of car may be a cause. (2WD ECU in 4WD vehicle)

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C1702

### COMPONENT LOCATION



### General Description

There is no hardware difference of the HECU according to the vehicle's specification, just software changes for different vehicle parameters used for ESC control. The HECU stores a classified variant code value according to the received data (engine types, engine displacements, and type of transmission). The HECU reads various parameters according to the stored variant value in the memory used by the ESC control.

### DTC Description

The HECU checks the variant code after ignition start up. If an inappropriate variant code is detected or there is no variant code, a fault is detected.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Internal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Replacement of PCM</li> <li>(ECM &amp; TCM)</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Once during startup.</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>After power on, the HECU does not receive a valid variant code information during the configuration time.</li> <li>HECU has no valid variant code stored in the EEPROM.</li> <li>The received CAN signals does not lead to a defined and supported variant code.</li> <li>If an ECU, which has already memorized a valid variant code information, receives a different variant code information. (at a next Power on cycle)</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>The ABS/EBD/ESC functions are inhibited.</li> <li>The ABS/EBD/ESC warning lamps are activated.</li> </ul>	

### Monitor Scantool Data

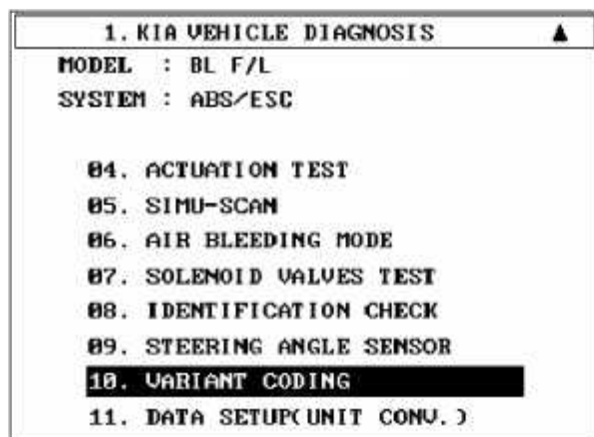
#### Variant Coding

1. Check for improper installation of EMS/PCM (ECM & TCM)/ESC.
2. Connect scantool to Data Link Connector (DLC).
3. Ignition "ON".
4. Go in Anti-Lock brake system (figure 1).
5. Perform variant code checks as per DTC found.

6. Disconnect scantool.

7. Ignition "OFF" and then ignition "ON". Go to "Component Inspection" Procedure.

\* For the vehicle equipped 4WD, delete the DTC(s) memorized in 4WD ECU when variant coding is completed.



**Fig1**

Fig 1) Variant coding.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C2112

### COMPONENT LOCATION



### General Description

The HECU supplies battery power to all solenoid valves with a valve relay which is controlled by the Electronic Control UNIT (ECU). The valve relay and all solenoid valves are installed inside the HECU (Hydraulic and Electronic Control Unit).

### DTC Description

The HECU monitors voltage of the valve relay to check if the HECU can perform ABS control normally. When the valve relay is switched to ON, the HECU will set this code if the solenoid drive voltage is below permissible voltage ranges for a period of time. When the valve relay is switched to OFF, the HECU sets this code if the solenoid drive voltage is over the permissible voltage range for a period of time.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Open or short in power supply circuit (IGN+)</li> <li>Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Once during startup.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Watchdog and valve relay function is tested during startup. A failure is detected if the valve relay/Enable remains in off position when it is turned on and vice versa. Reason could be short to GND or UZ, interrupted lines or a inoperative output stage etc.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A Fault is detected if valve relay voltage <math>&lt; 0.8 \times</math> battery voltage for a time 500 ms.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If valve relay malfunction and supply solenoid valve short to battery or supply solenoid valve and medium or high ohm short to valve relay (or a valve) to valve relay voltage, solenoid valve voltage or GND are detected.</li> </ul>	

Fail Safe	<ul style="list-style-type: none"> <li>• No valve actuation possible.</li> <li>• The ABS/EBD/ESC functions are inhibited.</li> <li>• The ABS/EBD/ESC warning lamps are activated.</li> </ul>
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### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of all valves with Actuation Test.

Specification : It's normal if operating sound is heard.

1.5 ACTUATION TEST 02/13

FRONT LEFT VALVE (IN)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE OFF

PRESS [STRT], IF YOU ARE READY !

[STRT]

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF".  
Ex) Actuation Test on Front left valve(in)

5. Do all valves operate normally?

**YES**

Fault is intermittent caused by poor connection in power harness (ABS2) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Power Circuit Inspection" procedure.

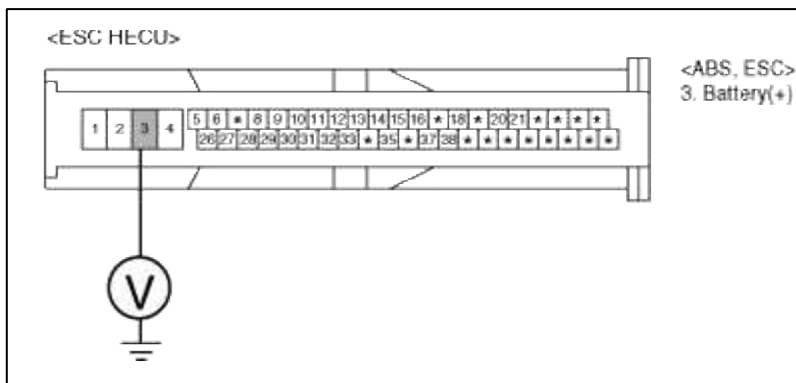
### Power Supply Circuit Inspection

1. Ignition "OFF".



2. Disconnect HECU connector.
3. Ignition "ON".
4. Measure voltage between terminal "3" of the HECU harness connector and chassis ground.

Specification : Approx. B+



5. Is the measured voltage within specifications?

**YES**

Go to "Ground Circuit Inspection" procedure.

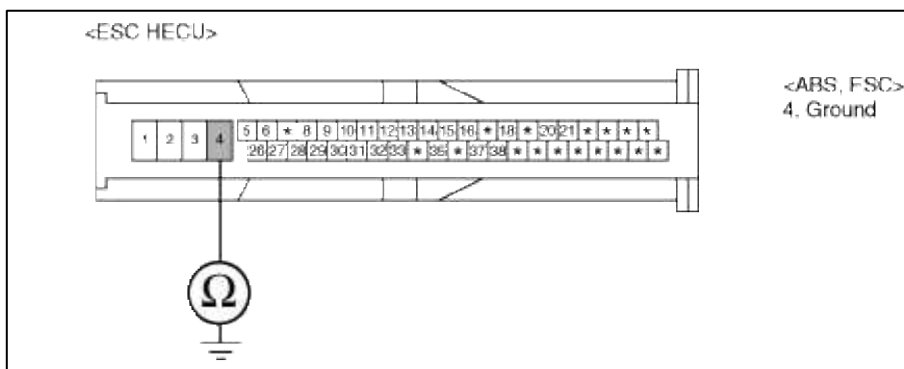
**NO**

Check for damaged harness and open or short to GND between the battery terminal(+) and terminal "3" of the HECU harness connector. Check for open or blown 20A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure.

#### Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1  $\Omega$



4. Is the measured resistance within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C2308

### COMPONENT LOCATION



### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpted drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• Immediately after power on</li> <li>• every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is found if UVR is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>• A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30 \text{ km/h}</math> (18.6 mph).</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10 \text{ bar}</math></li> <li>3. Vehicle speed <math>&gt; 15 \text{ km/h}</math> (9.3 mph).</li> <li>4. Vehicle acceleration <math>&gt; 0.5 \text{ m/s}^2</math></li> <li>5. Supply voltage <math>&gt; 11 \text{ volts}</math>.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 02/13	
FRONT LEFT VALVE(IN)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
<div>STRT</div>	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(in)

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).

4. Are any DTCs present?

**YES**

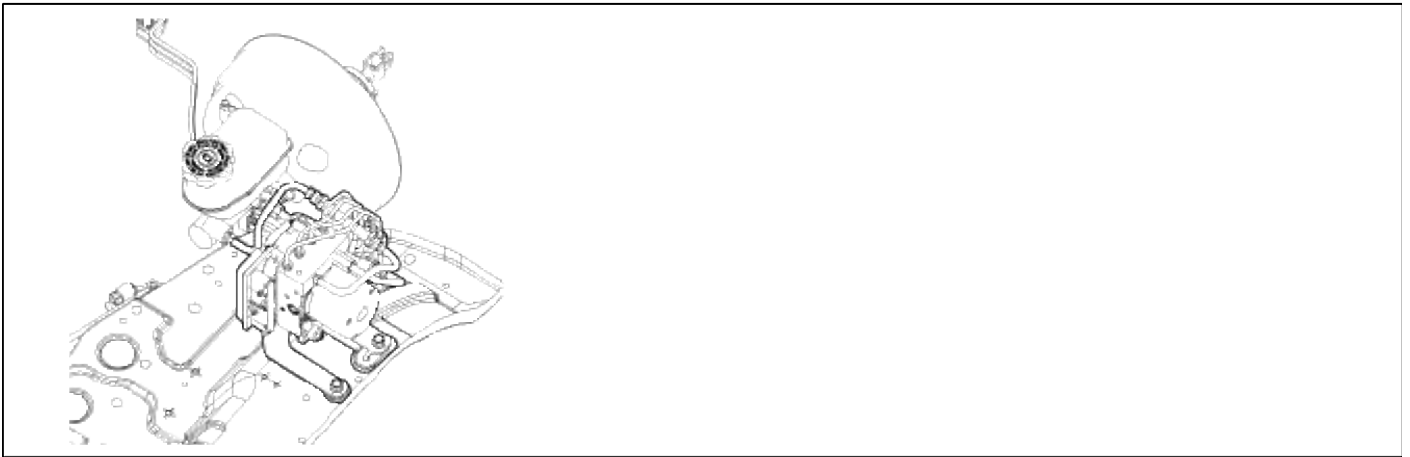
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C2312

#### COMPONENT LOCATION



#### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

#### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

#### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• Immediately after power on</li> <li>• every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is found if <math>UVR</math> is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>• A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30 \text{ km/h}</math> (18.6 mph).</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10 \text{ bar}</math></li> <li>3. Vehicle speed <math>&gt; 15 \text{ km/h}</math> (9.3 mph).</li> <li>4. Vehicle acceleration <math>&gt; 0.5 \text{ m/s}^2</math></li> <li>5. Supply voltage <math>&gt; 11 \text{ volts}</math>.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of outlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 06/13	
FRONT LEFT VALVE(OUT)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
<div>STRT</div>	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(out)

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).

4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C2316

#### COMPONENT LOCATION



#### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

#### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

#### DTC Detecting Condition



Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• Immediately after power on</li> <li>• every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is found if UVR is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>• A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30 \text{ km/h}</math> (18.6 mph).</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10 \text{ bar}</math></li> <li>3. Vehicle speed <math>&gt; 15 \text{ km/h}</math> (9.3 mph).</li> <li>4. Vehicle acceleration <math>&gt; 0.5 \text{ m/s}^2</math></li> <li>5. Supply voltage <math>&gt; 11 \text{ volts}</math>.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 02/13	
FRONT LEFT VALVE(IN)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(in)

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).

4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C2320

#### COMPONENT LOCATION



#### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

#### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

#### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• Immediately after power on</li> <li>• every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is found if UVR is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>• A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30 \text{ km/h}</math> (18.6 mph).</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10 \text{ bar}</math></li> <li>3. Vehicle speed <math>&gt; 15 \text{ km/h}</math> (9.3 mph).</li> <li>4. Vehicle acceleration <math>&gt; 0.5 \text{ m/s}^2</math></li> <li>5. Supply voltage <math>&gt; 11 \text{ volts}</math>.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of outlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 06/13	
FRONT LEFT VALVE(OUT)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(out)

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).

4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C2324

#### COMPONENT LOCATION



#### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

#### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

#### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• Immediately after power on</li> <li>• every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is found if UVR is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>• A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30 \text{ km/h}</math> (18.6 mph).</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10 \text{ bar}</math></li> <li>3. Vehicle speed <math>&gt; 15 \text{ km/h}</math> (9.3 mph).</li> <li>4. Vehicle acceleration <math>&gt; 0.5 \text{ m/s}^2</math></li> <li>5. Supply voltage <math>&gt; 11 \text{ volts}</math>.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 02/13	
FRONT LEFT VALVE(IN)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
<div>STRT</div>	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(in)

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).



4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C2328

#### COMPONENT LOCATION



#### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

#### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

#### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• Immediately after power on</li> <li>• every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is found if UVR is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>• A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30 \text{ km/h}</math> (18.6 mph).</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10 \text{ bar}</math></li> <li>3. Vehicle speed <math>&gt; 15 \text{ km/h}</math> (9.3 mph).</li> <li>4. Vehicle acceleration <math>&gt; 0.5 \text{ m/s}^2</math></li> <li>5. Supply voltage <math>&gt; 11 \text{ volts}</math>.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of outlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 06/13	
FRONT LEFT VALVE(OUT)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
[STRT]	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(out)

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).

4. Are any DTCs present?

**YES**

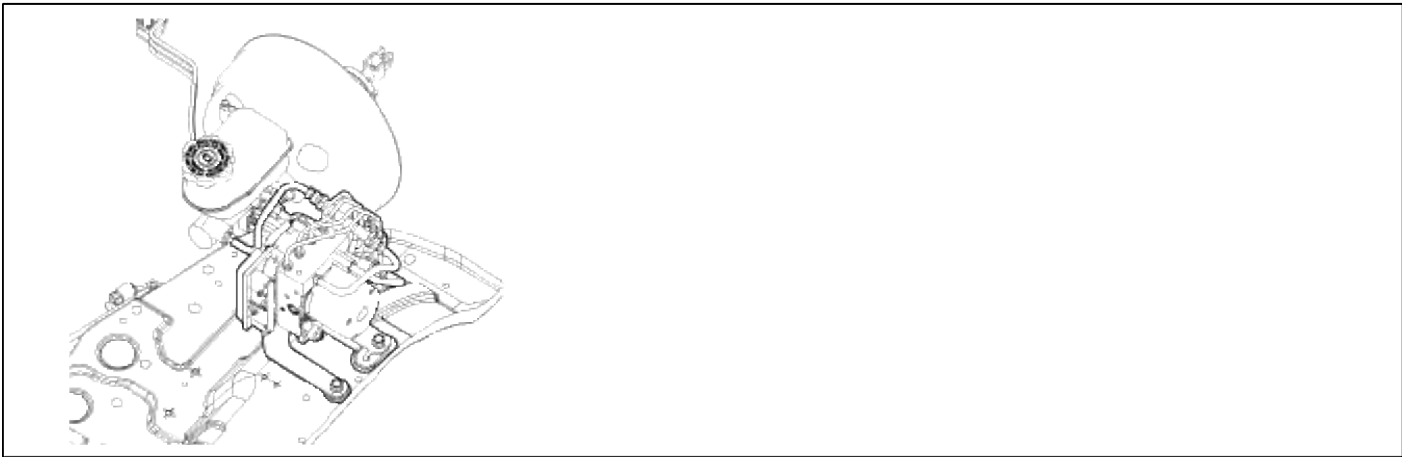
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C2332

#### COMPONENT LOCATION



#### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

#### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

#### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• Immediately after power on</li> <li>• every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is found if UVR is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>• A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30 \text{ km/h}</math> (18.6 mph).</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10 \text{ bar}</math></li> <li>3. Vehicle speed <math>&gt; 15 \text{ km/h}</math> (9.3 mph).</li> <li>4. Vehicle acceleration <math>&gt; 0.5 \text{ m/s}^2</math></li> <li>5. Supply voltage <math>&gt; 11 \text{ volts}</math>.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 02/13	
FRONT LEFT VALVE(IN)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(in)

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).

4. Are any DTCs present?

**YES**

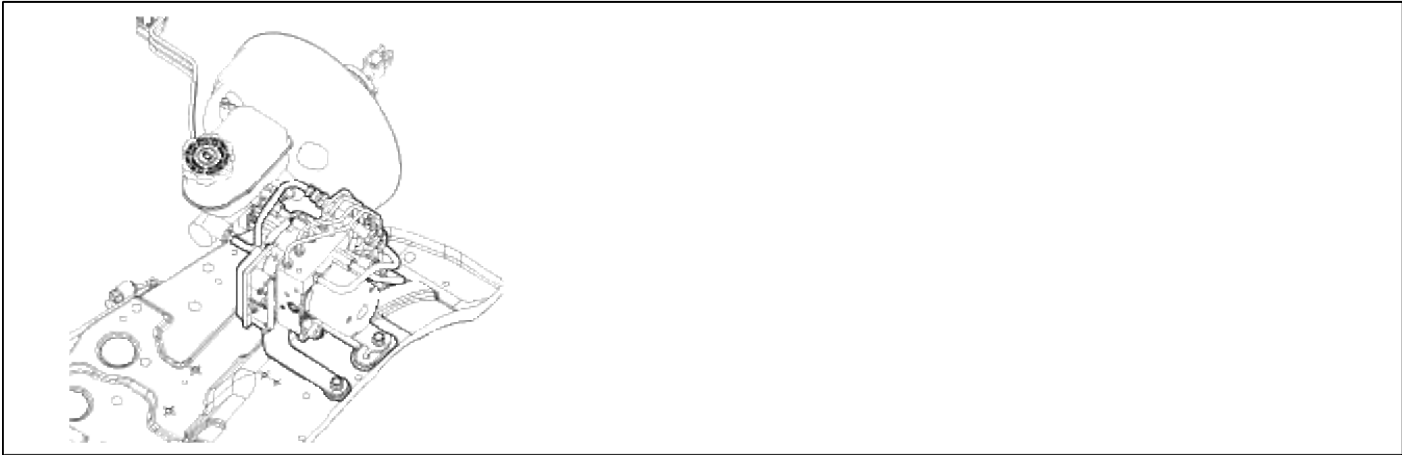
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C2336

#### COMPONENT LOCATION



#### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

#### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

#### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• Immediately after power on</li> <li>• every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• A Fault is found if UVR is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>• A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30 \text{ km/h}</math> (18.6 mph).</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10 \text{ bar}</math></li> <li>3. Vehicle speed <math>&gt; 15 \text{ km/h}</math> (9.3 mph).</li> <li>4. Vehicle acceleration <math>&gt; 0.5 \text{ m/s}^2</math></li> <li>5. Supply voltage <math>&gt; 11 \text{ volts}</math>.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	



### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of outlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 06/13	
FRONT LEFT VALVE(OUT)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(out)

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).

4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Brake System > Troubleshooting > C2366

#### COMPONENT LOCATION



#### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

#### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

#### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Once after ignition on at standstill if the BLS is off</li> <li>• At vehicle speed <math>\geq 15</math> km/h(9.3 mph) if the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h(9.3 mph)</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

#### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.

## 4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST		10/13
TCS VALVE(USV1)		
DURATION	2 SECONDS	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on TCS(USV) valve #1

## 5. Does a inlet valve operate normally?

YES

Fault is intermittent caused by inoperative valve or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

NO

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).
4. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

**Brake System > Troubleshooting > C2370****COMPONENT LOCATION****General Description**

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

**DTC Description**

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

**DTC Detecting Condition**

<b>Item</b>		<b>Detecting Condition</b>	<b>Possible cause</b>
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Once after ignition on at standstill if the BLS is off</li> <li>• At vehicle speed <math>\geq 15</math> km/h(9.3 mph) if the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h(9.3 mph)</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	

	Enable Conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>
	Fail Safe	<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESC function is prohibited.</li> <li>ABS/EBD/ESC warning lamp is turned ON.</li> </ul>

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 18/13	
TCS VALVE(USV1)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on TCS(USV) valve #1

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by inoperative valve or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C2372

### COMPONENT LOCATION



### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Once after ignition on at standstill if the BLS is off</li> <li>• At vehicle speed <math>\geq 15</math> km/h(9.3 mph) if the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h(9.3 mph)</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>• ABS/EBD/ESC function is prohibited.</li> <li>• ABS/EBD/ESC warning lamp is turned ON.</li> </ul>	

#### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.



## 4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST		10/13
TCS VALVE(USV1)		
DURATION	2 SECONDS	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on TCS(USV) valve #1

## 5. Does a inlet valve operate normally?

YES

Fault is intermittent caused by inoperative valve or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

NO

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).
4. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

**Brake System > Troubleshooting > C2374****COMPONENT LOCATION****General Description**

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

**DTC Description**

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

**DTC Detecting Condition**

<b>Item</b>		<b>Detecting Condition</b>	<b>Possible cause</b>
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>• Once after ignition on at standstill if the BLS is off</li> <li>• At vehicle speed <math>\geq 15</math> km/h(9.3 mph) if the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h(9.3 mph)</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	

	Enable Conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>
	Fail Safe	<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESC function is prohibited.</li> <li>ABS/EBD/ESC warning lamp is turned ON.</li> </ul>

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 18/13	
TCS VALVE(USV1)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

**Fig1**

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on TCS(USV) valve #1

5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by inoperative valve or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

**NO**

Go to "W/Harness Inspection" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).
4. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Brake System > Troubleshooting > C2402

### COMPONENT LOCATION



### General Description

The HECU supplies battery power to the electric motor with a motor relay which is controlled by the Electronic Control Unit(ECU). The electric motor pump supplies hydraulic pressure to all wheel brake calipers by operating the piston inside the pump.

### DTC Description

The ABS ECU monitors the pump motor relay or fuse open, open or short in motor or motor lock and then sets this code if a malfunction is detected.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• Voltage Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short of power supply circuit (ESC2)</li> <li>• Faulty HECU</li> </ul>
Case1 (Motor Relay continuous off, Open, Fuse blown)	Detect Mode	<ul style="list-style-type: none"> <li>• Continuous (If the pump is switched on (FET on))</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• If the motor relay is switched ON and motor voltage &lt; (IGN voltage – 4.0V) continued for 100msec, the failure is detected.</li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>• Pressure decrease is no longer possible. (wheels block)</li> <li>• The ABS/ESC functions are inhibited and the EBD function is reduced.</li> <li>• The ABS/EBD/ESC warning lamps are activated.</li> </ul>	
Case2 (Motor Lock)	Detect Mode	<ul style="list-style-type: none"> <li>• Continuous (If the pump is in the transition "on → off")</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• After the end of the actuation of the motor relay, the pump motor is still in motion and is generating a voltage during it's slowdown. The generated motor voltage is monitored for a certain time on high level. The time depends on the supply voltage and is in the range of 300ms to 125ms. If the slow down condition isn't met, the pump is activated again and the slowdown time is measured again. This is repeated for maximum 3times. If, after the last pump activation, the pump motor slowdown time is still too short, a failure is detected. 1st actuation : 200ms 2st actuation : 1000ms 3st actuation : 3000ms</li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>• Pressure decrease is no longer possible. (wheels block)</li> <li>• The ABS/ESC functions are inhibited and the EBD function is reduced.</li> <li>• The ABS/EBD/ESC warning lamps are activated.</li> </ul>	
Case3 (Ground loss, Motor relay continuous on, Motor Short to BATT)	Detect Mode	<ul style="list-style-type: none"> <li>• Continuous (If the pump is switched off i.e. not actuation and no slowdown)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>• Motor relay is switched OFF, VMR &gt; 2.0V continued for 1sec, the failure is detected.</li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>• The return pump does not work correct.</li> <li>• The ABS/ESC functions are inhibited and the EBD function is reduced.</li> <li>• The ABS/EBD/ESC warning lamps are activated.</li> </ul>	

#### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.

## 4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.5 ACTUATION TEST 01/13	
<b>MOTOR</b>	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY !	
STRT	

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on motor

## 5. Does a inlet valve operate normally?

**YES**

Fault is intermittent caused by poor connection in motor circuit or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure.

## Terminal &amp; Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

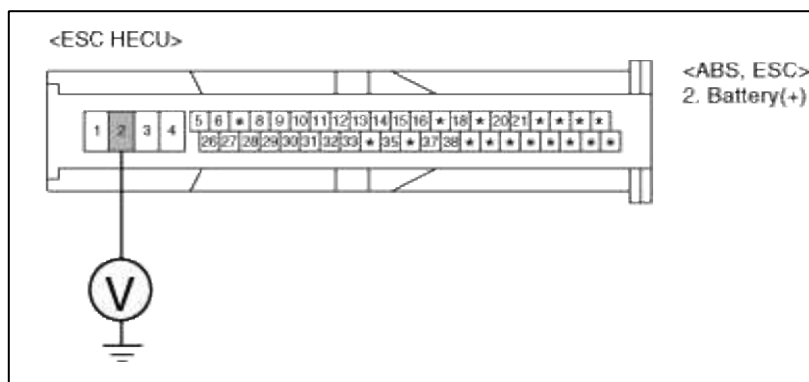
Go to "Power Circuit Inspection" procedure.

## Power Supply Circuit Inspection

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Ignition "ON".

4. Measure voltage between terminal "2" of the HECU harness connector and chassis ground.

Specification : Approx. B+



5. Is the measured voltage within specifications?

**YES**

Go to "Ground Circuit Inspection" procedure.

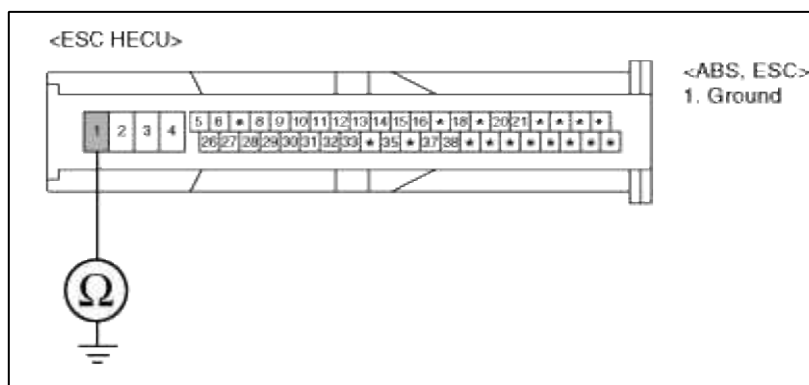
**NO**

Check for damaged harness and open or short to GND between the battery terminal(+) and terminal "2" of the HECU harness connector. Check for open or blown 40A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification Of vehicle Repair" procedure.

#### Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1" of the HECU harness connector and chassis ground.

Specification : Approx. below 1  $\Omega$



4. Is the measured resistance within specifications?

**YES**

Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

Check for damaged harness and poor connection between terminal "1" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode

2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh(18.6mph).
4. Are any DTCs present?

**YES**

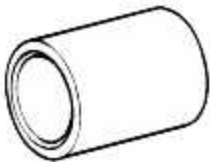





Go to the applicable troubleshooting procedure.

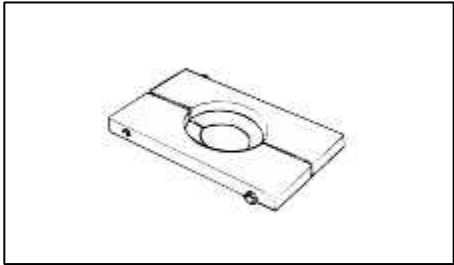
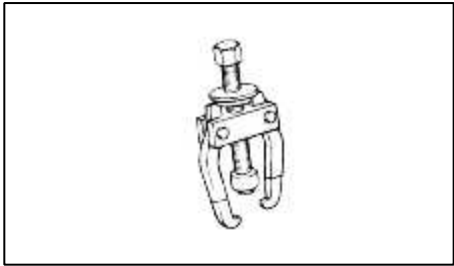
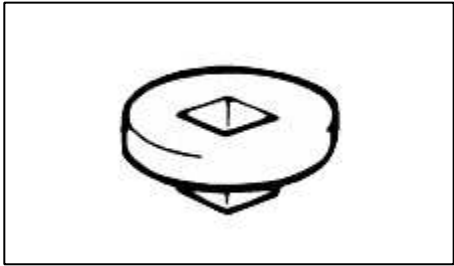
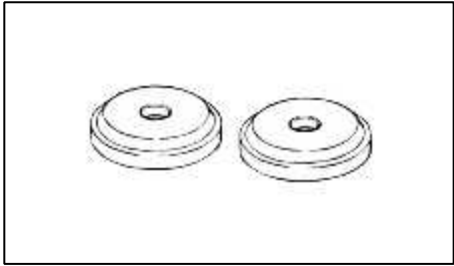
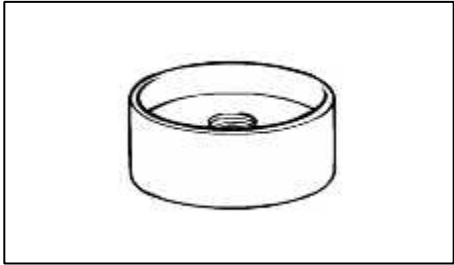
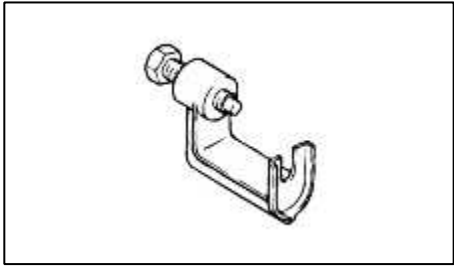
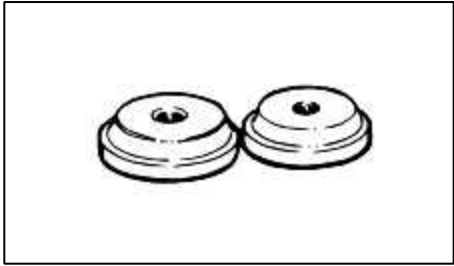
**NO**


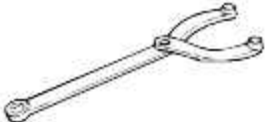


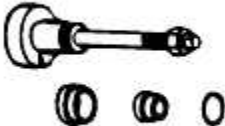
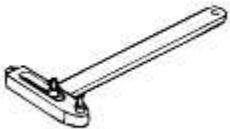

System performing to specification at this time.



**SORENTO(BL) > 2007 > G 3.3 DOHC > Driveshaft and axle****Driveshaft and axle > General Information > Special Service Tools****SPECIAL TOOL**

<b>Tool (Number and Name)</b>	<b>Illustration</b>	<b>Use</b>
Bushing remover and installer 09216-21100		Press-fitting of the inner shaft housing dust seal
Bearing outer race installer 09432-33700		Installation of the front hub bearing (Use with 09500-21000)
Bar 09500-21000		Installation of the front hub bearing (Use with 09432-33700)
Draft 09517-21400		Removal of the outer race from the carrier
Universal joint remover 09493-43000		Removal and installation of the journal bearing
Oil seal installer 09517-21000		Press-fitting of the differential drive pinion oil seal (Use with 09500-21000)

Remove plate 09527-4A000		Removal of the differential drive pinion inner bearing
Bearing puller 09517-43001		<ul style="list-style-type: none"> <li>• Removal of the front lower arm ball joint</li> <li>• Removal of the differential side bearing</li> </ul>
Preload socket 09532-11600		Measurement of the drive pinion starting torque (Use with torque wrench)
Oil seal installer 09532-32000		Installation of the differential drive pinion front bearing outer race
Oil seal installer 09542-4A000		Press-fitting of the oil seal into knuckle (Use with 09500-11000)
Ball joint remover 0K670 321 019		Disconnection of the tie rod ball joint
Oil seal installer 09532-32100B		Installation of the differential drive pinion rear bearing outer race (Use with 09500-11000)

Working base 09517-43401		Supporting for the differential carrier
End yoke holder 09517-21700		Removal and installation of the differential self-locking nut
Drive pinion 0K993 270 A09		For adjusting height of drive pinion
Gauge block 0K993 270 A08		
Drive pinion model 0K993 270 A10		
Adjusting nut wrench 0K993 270 014		
LSD test adapter 09530-FM000		For testing of LSD performance.

**Driveshaft and axle > General Information > Troubleshooting**
**TROUBLESHOOTING**

	<b>Symptom</b>	<b>Probable cause</b>	<b>Remedy</b>
Propeller shaft	Noise at start	Worn journal bearing Worn sleeve yoke spline or flange yoke Loose propeller shaft installation	Replace Replace Retighten
	Noise and vibration at high speed	Unbalanced propeller shaft Improper snap ring selection Worn journal bearing	Replace Adjust the clearance Replace
Drive shaft, Inner shaft	Noise during wheel rotation	Housing tube bent Inner shaft bent Inner shaft bearing worn, pounding Drive shaft assembly worn damaged, bent	Replace  Replace Check or replace
	Noise due to excessive play of wheel in turning direction	Inner shaft and side gear serration play Drive shaft and side gear serration play	Replace
Axle shaft, axle housing	Noise while wheels are rotating	Bent axle shaft Worn or scarred axle shaft bearing	Replace Replace
	Grease leakage	Worn or damaged oil seal Malfunction of bearing seal	Replace Replace
Differential	Constant noise	Improper drive gear and drive pinion gear tooth contact Loose, worn or damaged side bearing Loose, worn or damaged drive pinion bearing Worn drive gear, drive pinion Worn side gear thrust washer or pinion shaft Deformed drive gear of differential case Damaged gear Foreign material  Insufficient oil	Correct or replace       Eliminate the foreign (Replace the parts if necessary) Replenish
Differential	Gear noise while driving	Poor gear engagement Improper gear adjustment Improper drive pinion	Correct or replace

	preload adjustment Damaged gear Foreign material  Insufficient oil	Replace Eliminate the foreign material and check (Replace the parts if necessary) Replenish
Gear noise while coasting	Improper drive pinion preload adjustment Damaged gear	Correct or replace Replace
Bearing noise while driving or coasting	Cracked or damaged drive pinion rear bearing	Replace
Noise while turning	Loose side bearing Damaged side gear, pinion gear or pinion shaft	Replace
Heat	Improper gear backlash Excessive preload Insufficient oil	Adjust  Replenish
Oil leakage	Differential carrier not tightened  Seal malfunction Worn or damaged oil seal Excessive oil	Retighten, apply sealant, or replace the gasket  Replace Adjust the oil level

**Driveshaft and axle > General Information > Specifications**
**SPECIFICATIONS**

**PROPELLER SHAFT**

ITEMS	SPECIFICATION	
	Full Time 4WD	Part Time 4WD
Joint type Front Rear	C.V.J. + U.J. U.J. + U.J.	U.J. + U.J. U.J. + U.J.
Length x O.D mm (in.) Front <Mark> Rear (4WD)<Mark> Rear (2WD)<Mark>	595x63.5 (23.4x2.5) <Silver> 1070~1095x76.2 (42.1~43.1x3.0) <Silver>	591x63.5 (23.4x2.5) <Silver> 1070~1095x76.2 (42.1x43.1x3.0) <Silver> 1503x76.2 (59.1x3.0) <Silver>
Runout mm (in.)	0.3mm (0.012 in.) or less	0.3mm (0.012 in.) or less

U.J. : Universal Joint

2 WD : 2 Wheel Drive

C.V.J. : Constant Velocity Joint

4 WD : 4 Wheel Drive

Mark : Tag color

**FRONT AXLE AND DRIVESHAFT**

ITEMS	SPECIFICATION
Front axle hub bearing type	Double taper roller bearing
Driveshaft joint type (4WD) Outer Inner	B.J. T.S.J.
Differential (4WD) Reduction gear type Reduction ratio	Hypoid gear 4.666

B.J. : Birfield Joint

T.S.J. : Three Spherical Joint

**REAR AXLE AND AXLE SHAFT**

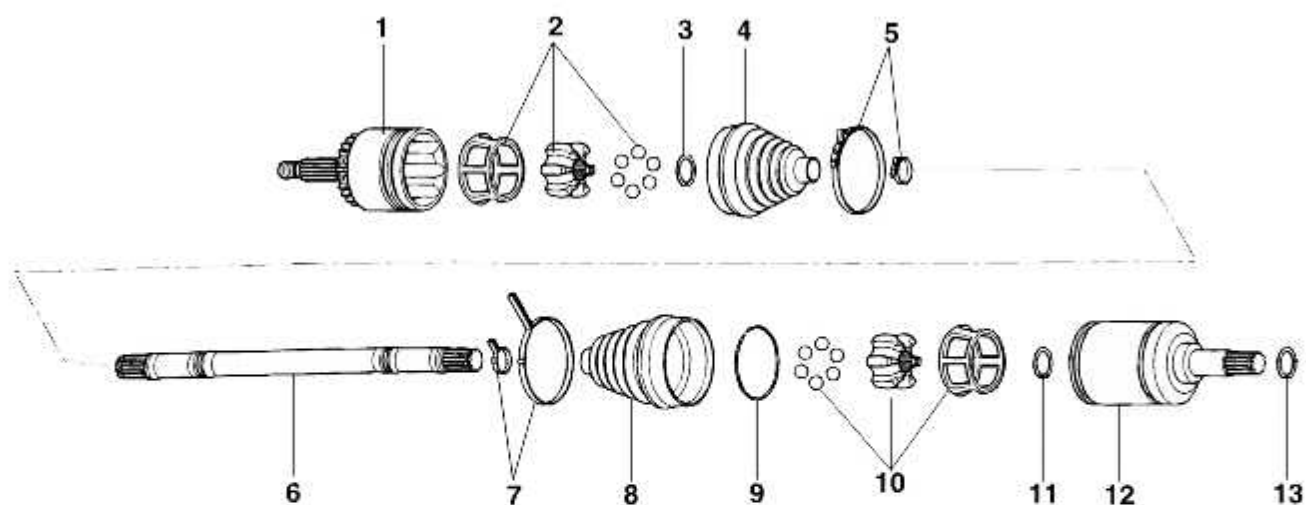
ITEMS	SPECIFICATION
Axle housing type	Banjo type
Axle shaft supporting type	Semi-floating type
DIFFERENTIAL Reduction gear type Reduction gear ratio	Hypoid gear 4.666

## LUBRICANTS

Items	Specified lubricants	Quantity
<b>B.J. - T.S.J. Drive shaft type</b>		
<b>B.J. Boot grease</b>	<b>Repair kit grease</b>	<b>170 gr. (6.0 oz.)</b>
<b>T.S.J. Boot grease</b>	<b>Repair kit grease</b>	<b>140 gr. (4.9 oz.)</b>
<b>Differential</b>		
Front	Hypoid gear oil	Fill the reservoir to the plug hole
Rear	SAE90, API GL-5	Front : 1.3L (0.34 gal)
Conventional differential	(Mobil : Mobil Lube HD Shell : Shell Spirax HD)	Rear : 1.6L (0.42 gal)
With LSD;(Limited Slip Differential)	SAE85W90, API GL-5 (Mobil : INFILREX 33,SK : G-LS)	

**Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location**

COMPONENTS (T.S.J.-B.J.)



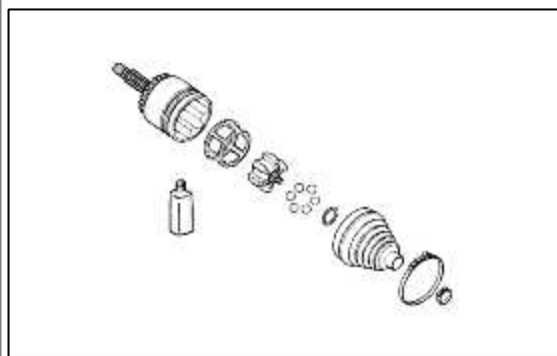
- |                            |                               |
|----------------------------|-------------------------------|
| 1. B.J assembly            | 7. T.S.J boot band            |
| 2. B.J inner race and ball | 8. T.S.J boot                 |
| 3. Snap ring               | 9. Circlip                    |
| 4. B.J boot                | 10. T.S.J inner race and ball |
| 5. B.J boot band           | 11. Snap ring                 |
| 6. Drive shaft             | 12. T.S.J assembly            |
|                            | 13. Clip                      |

## REPAIR KIT

Kit name	Illustration	Components
T.S.J boot kit		<ul style="list-style-type: none"> <li>• T.S.J boot band</li> <li>• T.S.J boot</li> <li>• Snap ring</li> <li>• Spider assembly</li> <li>• Snap ring</li> <li>• T.S.J assembly</li> <li>• Clip</li> <li>• Grease</li> </ul>



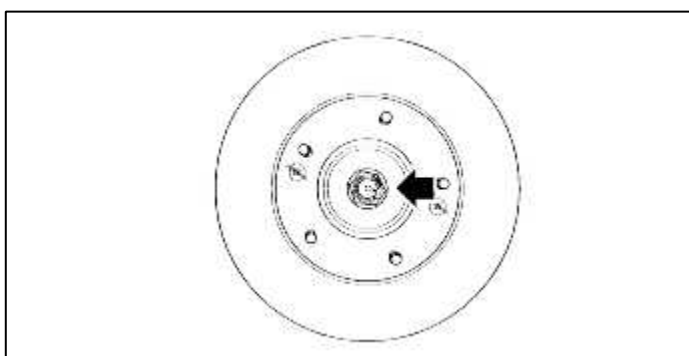
## B.J boot kit



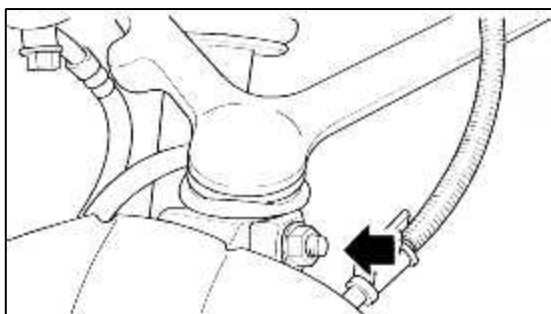
- B.J assembly
- B.J inner race and ball
- Snap ring
- B.J boot
- B.J boot band
- Grease

**Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures**
**REMOVAL (HALFSHAFTS)**

1. Remove the lock nut from front hub.



2. Remove the upper control arm link lock bolt, spring washer and nut.



3. Remove tie rod end cotter pin and using a ball joint puller, remove tie rod end from steering knuckle.

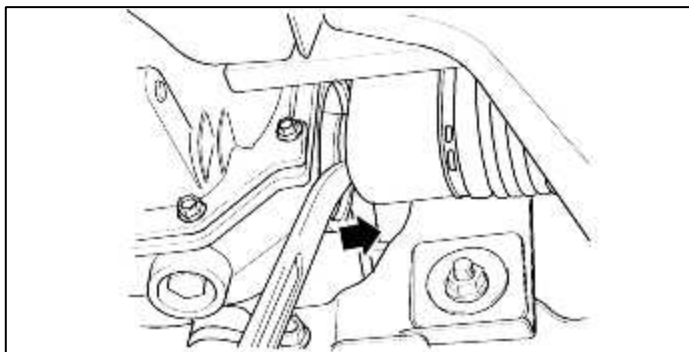


4. Mark drive shaft for identical installation position.

5. Using tool, pry the drive shaft from the differential housing.

**NOTE**

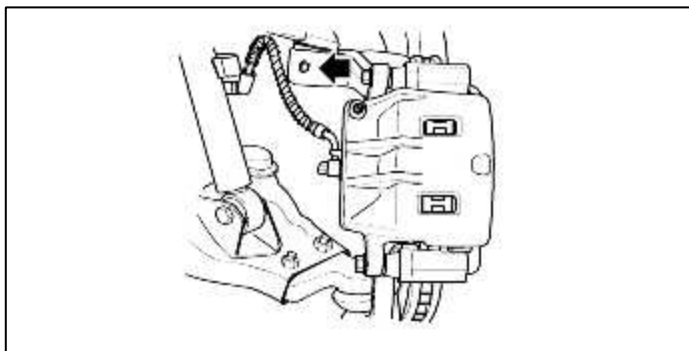
- Do not pull on the drive shaft doing so will damage the boots. Be sure to use the pry bar.



6. Remove the drive shaft from the knuckle

**NOTE**

- Temporarily install the knuckle to the upper arm.



## INSTALLATION

1. Coincide the joining mark between the drive shaft and the differential and insert the shaft.

**CAUTION**

- Insert the drive shaft (RH side) carefully into the oil seal to avoid any damage.

2. Install the knuckle assembly and tighten.

(1) Tie-rod ball joint

---

Tightening torque :

70-80 N·m (7.0-8.0 kg·m, 51-57 lb·ft)

---

(2) Upper arm link lock bolt

---

Tightening torque :

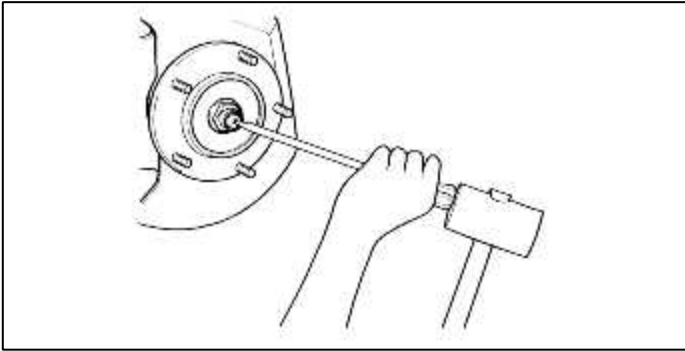
44-55 N·m (4.4-5.5 kg·m, 32-39 lb·ft)

---

3. Tighten the lock nut and then caulk the flange of lock nut on the end of drive shaft.

Tightening torque :

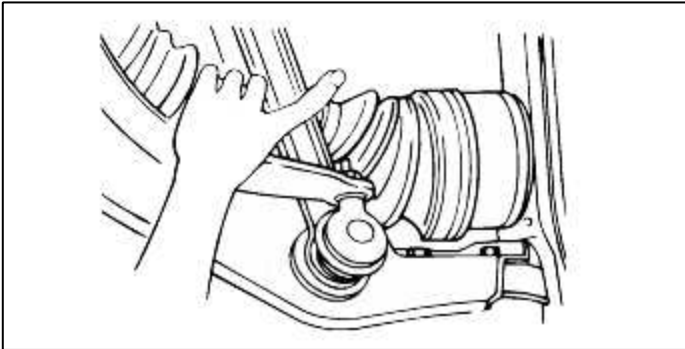
245-275 N·m (24.5-27.5 kg·m, 177-198 lb·ft)



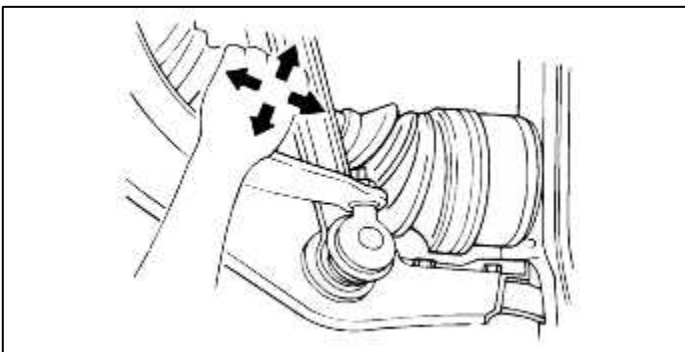
4. Install wheel and tire.

## INSPECTION

1. Inspect for torn or loose CV joint boots.



2. Test for loose drive shaft splines. By grasping the drive shaft and tugging up and down and fore and aft.
3. Also inspect for bent or broken drive shaft.



## DISASSEMBLY

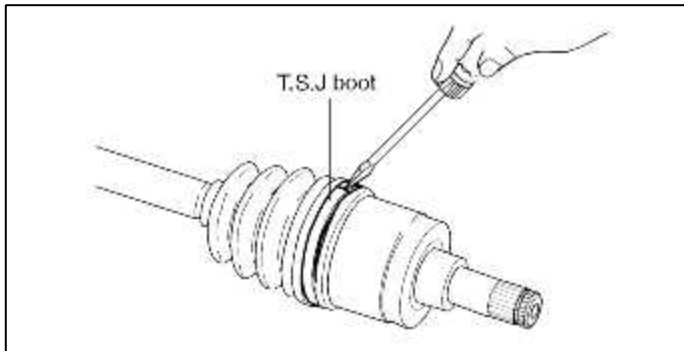
### NOTE

- Do not disassemble the B.J assembly.
- The Drive shaft joint uses special grease. Do not substitute with another type of grease.
- The Boot band should be replaced with a new one.

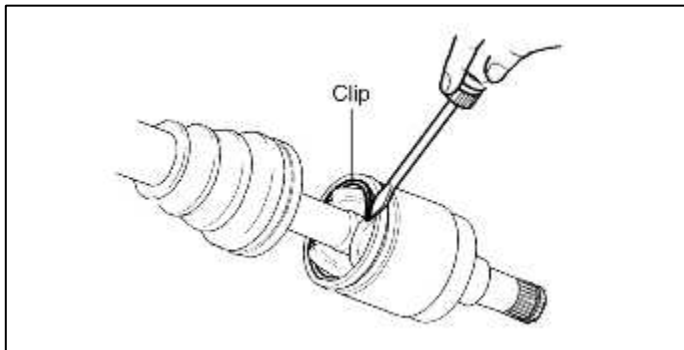
1. Remove the T.S.J boot band and pull the boot from T.S.J outer race.

**NOTE**

Be careful not to damage it.



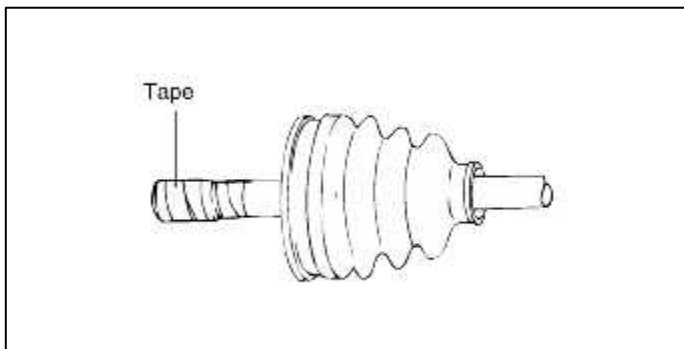
2. Remove the clip using a screwdriver.



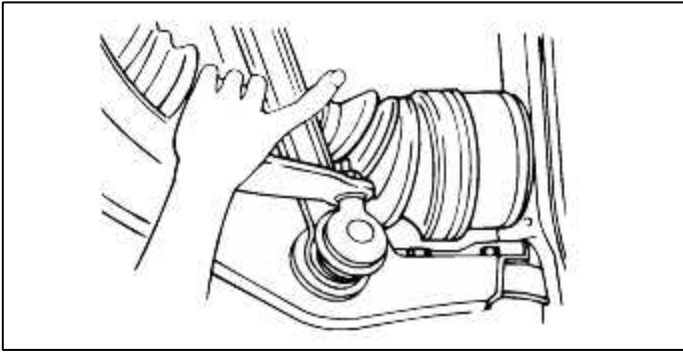
3. Remove the drive shaft from the T.S.J outer race.
4. Remove the snap ring and disassemble the inner race and ball from the shaft.
5. Remove the B.J boot band and pull out the T.S.J boot and the B.J boot.

**CAUTION**

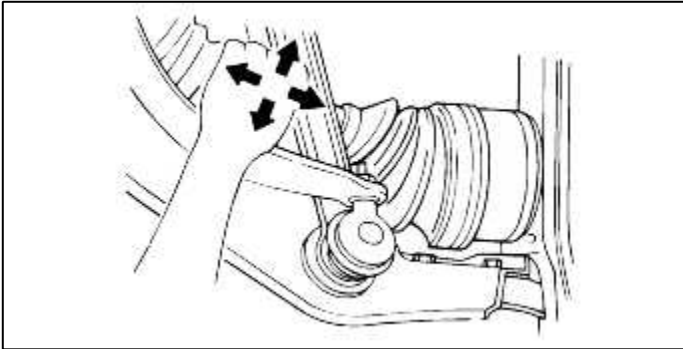
If the boot is reused, wrap a tape around the drive shaft splines to protect the boot.

**INSPECTION**

1. Inspect for torn or loose CV joint boots.



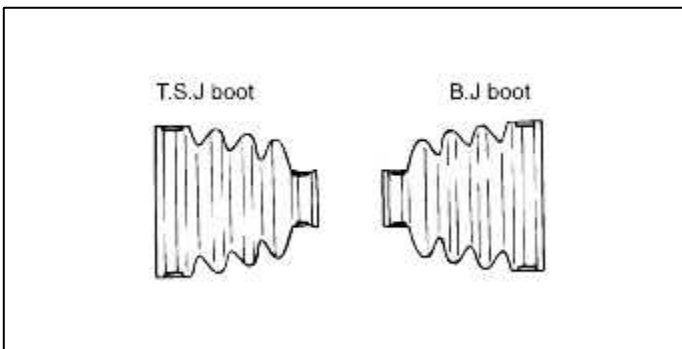
2. Test for loose drive shaft splines. By grasping the drive shaft and tugging up and down and fore and aft.
3. Also inspect for bent or broken drive shaft.



## REASSEMBLY

1. Wrap a tape around the drive shaft spline (T.S.J side) to avoid boot damage.
2. Apply specified grease to the drive shaft and install the boots.

Items	Quantity (gr.)
B.J	170
T.S.J	140

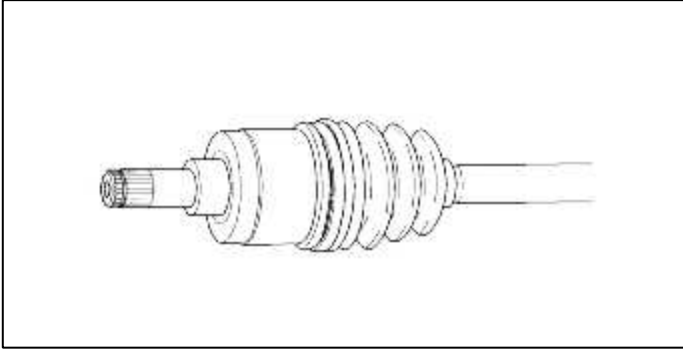


3. Add specified grease as much as was wiped away at the time of inspection.

#### 4. Tighten the boot bands.

##### CAUTION

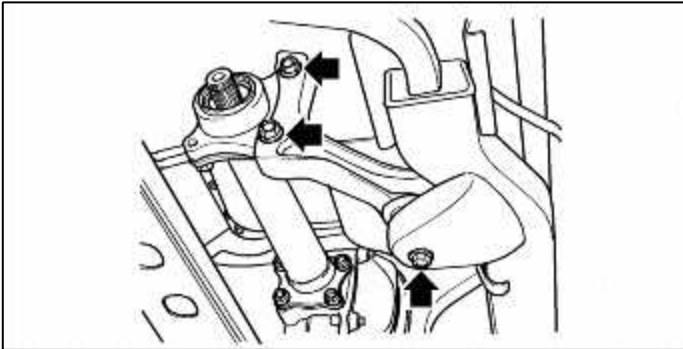
Keep the specified distance between the boot bands to control the air when they are tightened.



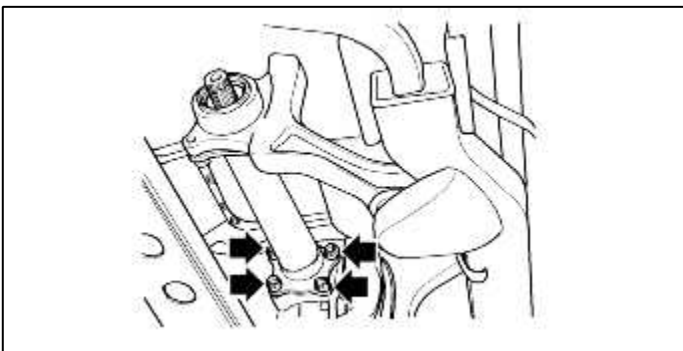
### Driveshaft and axle > Driveshaft Assembly > Center Bearing And Inner Shaft > Repair procedures

#### REMOVAL (OUTPUT SHAFT)

1. Remove diff mounting bracket.



2. Remove output shaft from differential housing.

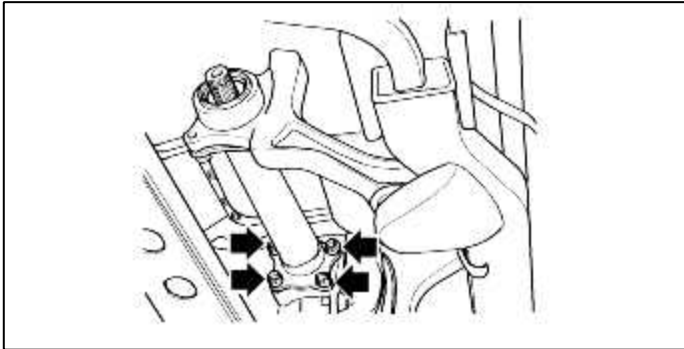


#### INSTALLATION

### 1. Install output shaft to differential case.

Tightening torque :

80-120 N·m (8-12 kg·m, 58-86 lb·ft)



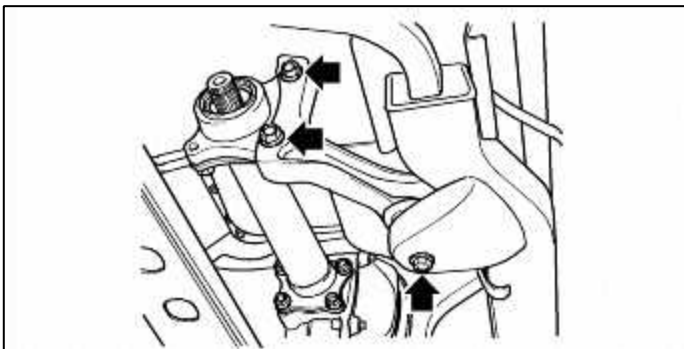
#### CAUTION

- Be carefully that oil seal does not damage by clip during install.

### 2. Install diff mounting bracket to the bearing housing.

Tightening torque :

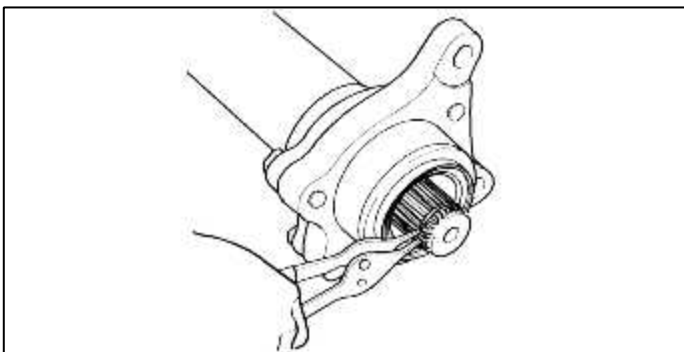
110-150 N·m (11-15 kg·m, 80-108 lb·ft)



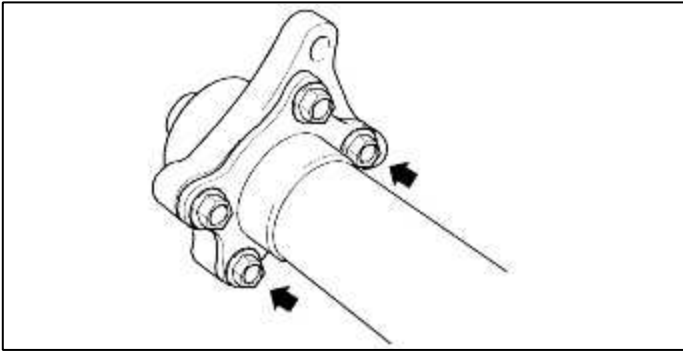
### 3. Tighten diff mounting bracket bolt.

## DISASSEMBLY

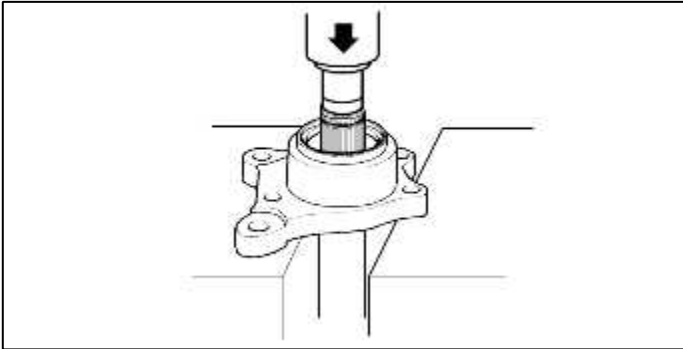
### 1. Remove axle clip using plier.



2. Remove output shaft housing.



3. Using a hydraulic press, remove bearing housing from the output shaft.



4. Remove dust seal and then using a hydraulic press, remove bearing.

## INSPECTION

- Output shaft for damage.
- Bearing for roughness or noise.
- Dust seal for damage.
- Bearing housing for cracks.

## REASSEMBLY (OUTPUT SHAFT)

1. Install dust seal into bearing housing.

### NOTE

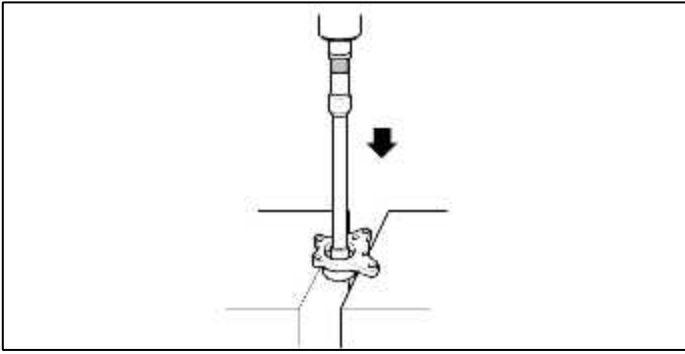
- Apply the grease on the lip of dust seal.



2. Using a hydraulic press, install bearing onto output shaft.



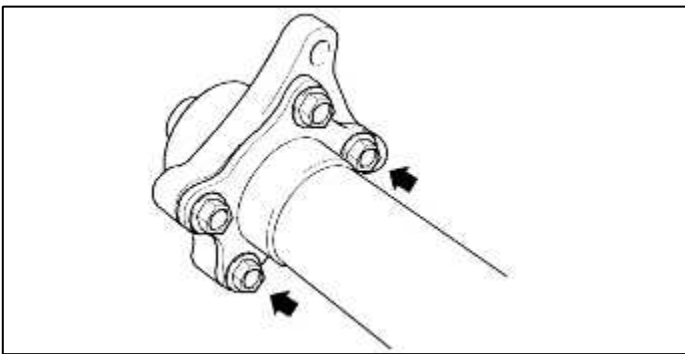
3. Using a hydraulic press, install shaft with bearing into bearing housing.



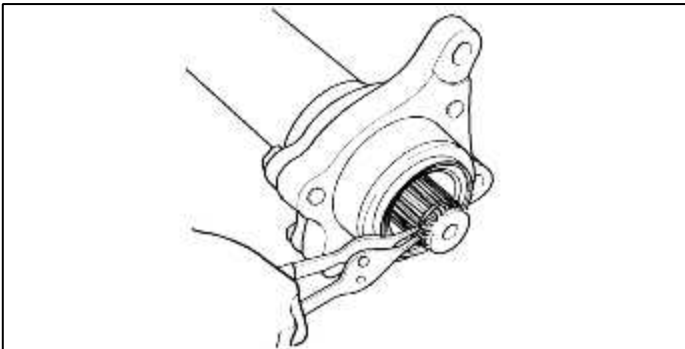
4. Install the output shaft housing to the bearing housing.

Tightening torque :

71-95 N·m (7.1-9.5 kg·m, 51-68 lb·ft)



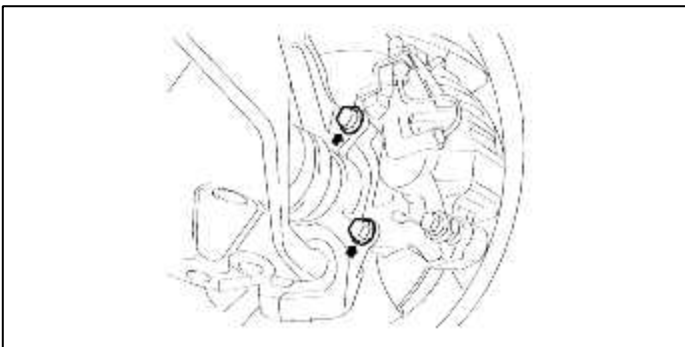
5. Using a plier, install new clip onto output shaft.



### Driveshaft and axle > Front Axle Assembly > Front Hub / Axle > Repair procedures

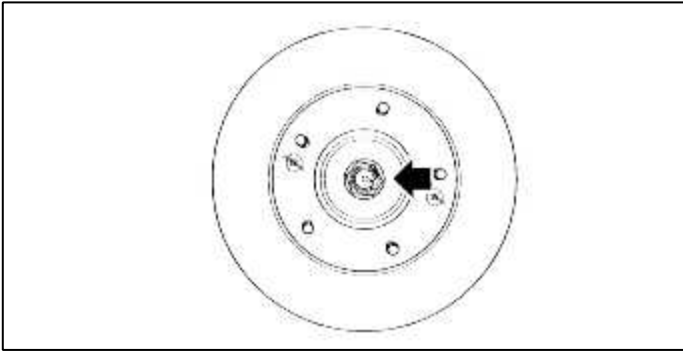
#### REMOVAL

1. Remove the vehicle speed sensor.
2. Remove two bolts and remove brake caliper from brake rotor. Temporarily tie caliper to vehicle frame with wire.

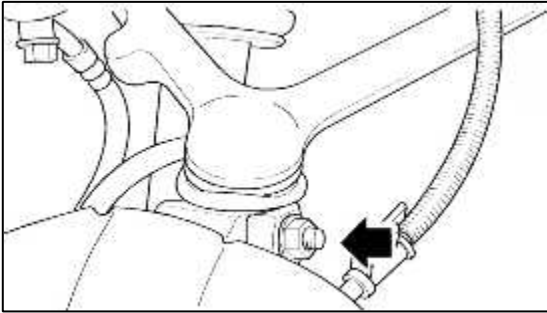


3. Remove two screws and remove brake rotor.

4. Using a lock nut wrench (or equivalent), remove lock nut and plain washer (2WD).



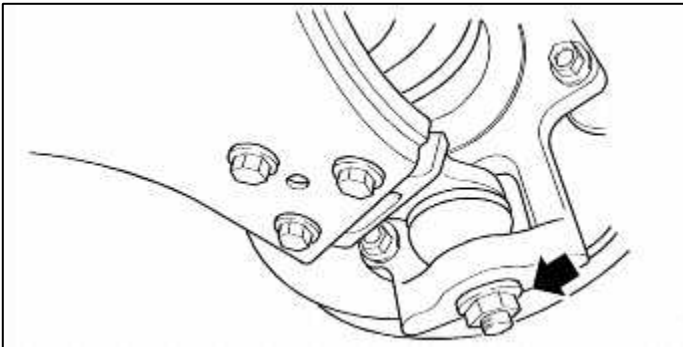
5. Remove the upper arm link lock bolt, spring washer and nut.



6. Remove tie rod end cotter pin and using a ball joint remover, remove tie rod end from steering knuckle.



7. Remove lower arm cotter pin using a ball joint remover, and remove lower arm from steering knuckle.



8. Remove steering knuckle from vehicle.

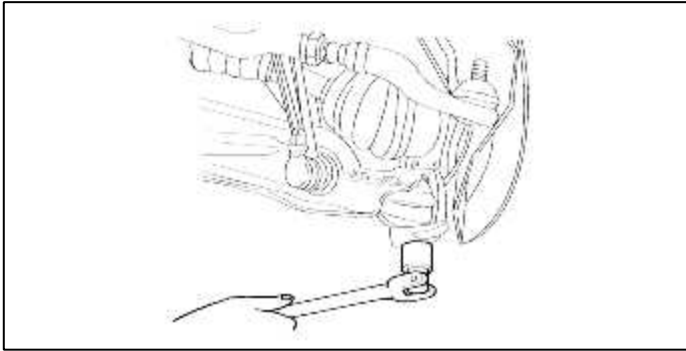
## INSTALLATION

1. Put steering knuckle on the drive shaft end with upper and lower ball joints in mounting holes.

2. Attach lower arm, tighten lock nut, and install cotter pin.

Tightening torque :

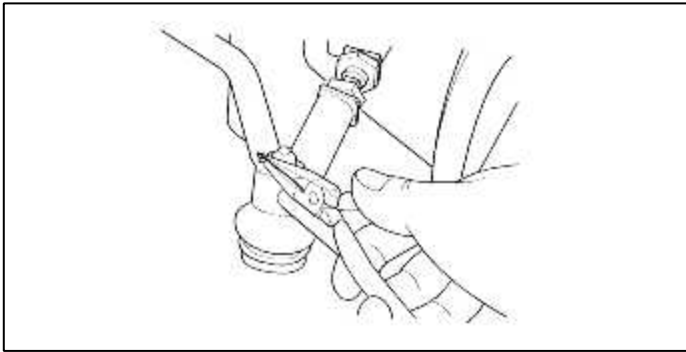
160-180 N·m (16.0-18.0 kg·m, 116-130 lb·ft)



3. Attach tie rod end to knuckle, tighten nut, and install cotter pin.

Tightening torque :

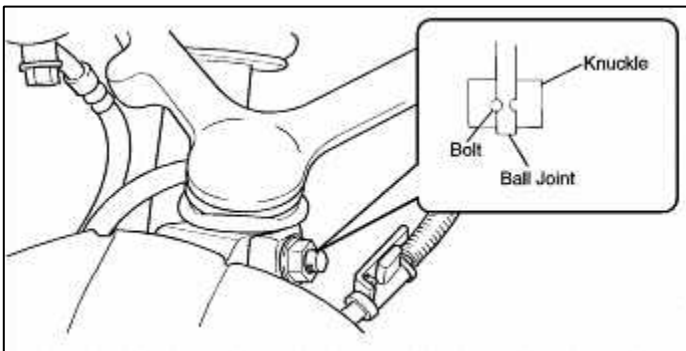
70-80 N·m (7.0-8.0 kg·m, 51-57 lb·ft)



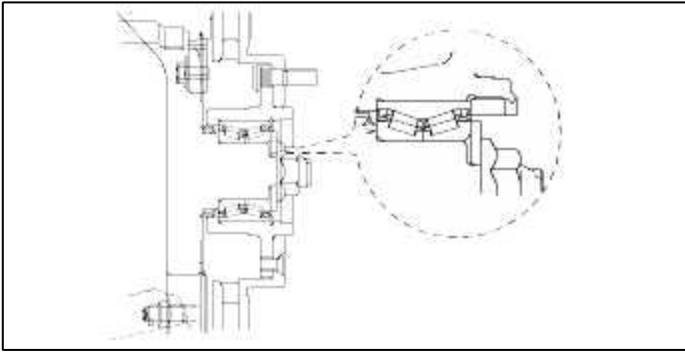
4. Insert upper arm link lock bolt with spring washer and tighten nut.

Tightening torque :

44-55 N·m (4.4-5.5 kg·m, 32-39 lb·ft)



5. Install the chamfer of plain washer toward the bearing (2WD)



6. Screw lock nut up against wheel hub assembly and using a lock nut wrench, tighten nut to tightening torque to set bearing preload. Use spring scale to measure.

---

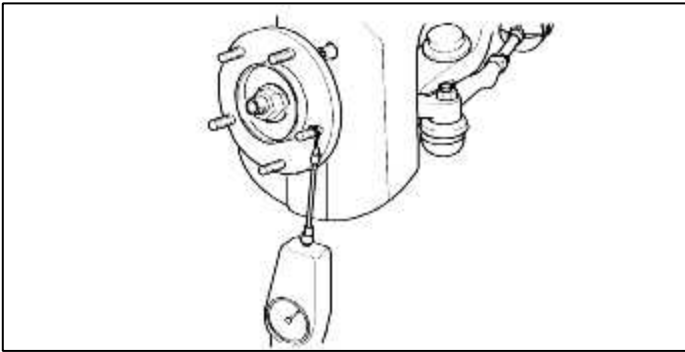
Bearing preload : 10 lb·in (Max 60 kg·cm)

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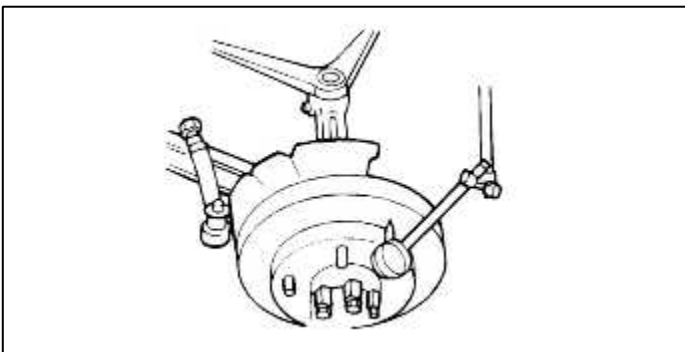
Tightening torque :

245-275 N·m (24.5-27.5 kg·m, 178-198 lb·ft)

---



7. Caulk the flange of lock nut on the end of drive shaft.  
8. Put brake rotor on wheel bearing hub bolts and install the two retaining screws.  
9. Mount dial indicator with plunger zeroed against brake rotor at 4.7 in (12 cm) from rotor center.



10. Turn rotor and read dial indicator for run out dimension.

---

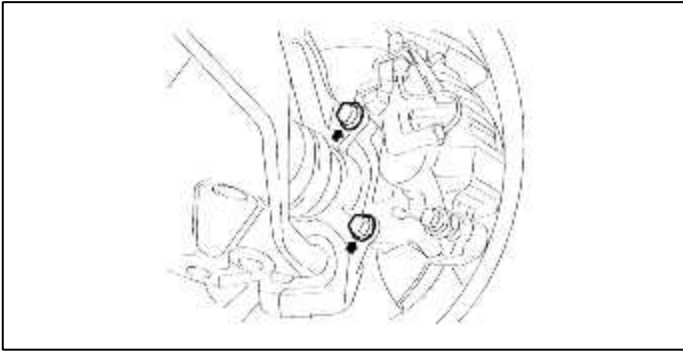
Run out not to exceed 0.0012 inch (0.03 mm)

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11. Install brake caliper and tighten two bolts.

Tightening torque :

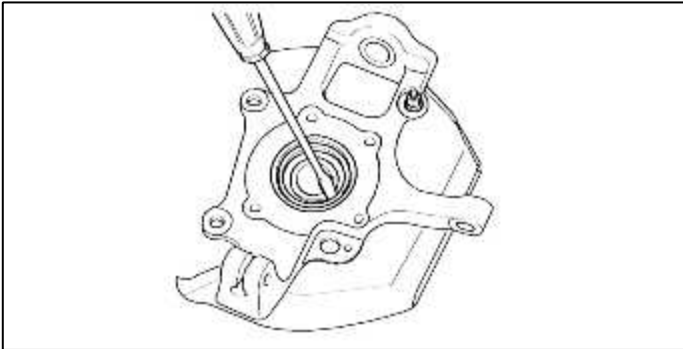
80-104 N·m (8.0-10.4 kg·m, 57-75 lb·ft)



12. Install wheel and tire.

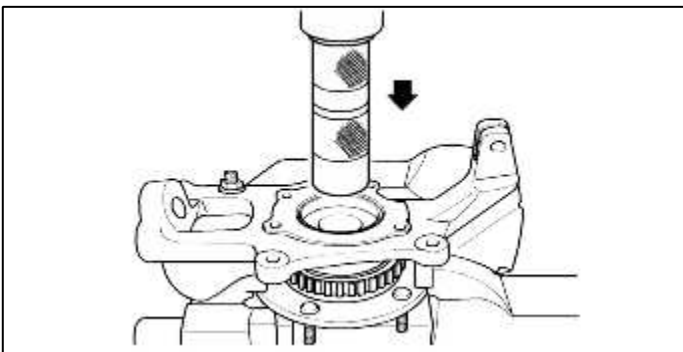
## DISASSEMBLY

1. Using a screwdriver, pry out oil seal from knuckle (4WD).



2. Press the wheel hub from the knuckle (4WD).

Press the knuckle and then remove wheel hub (2WD).



## INSPECTION

1. Inspect bearing for wear or damage.
2. Inspect steering knuckle for wear or damage.

## REASSEMBLY

1. Install the dust cover to the knuckle.

Tightening torque :

16-23 N·m (1.6-2.3 kg·m, 12-16 lb·ft)

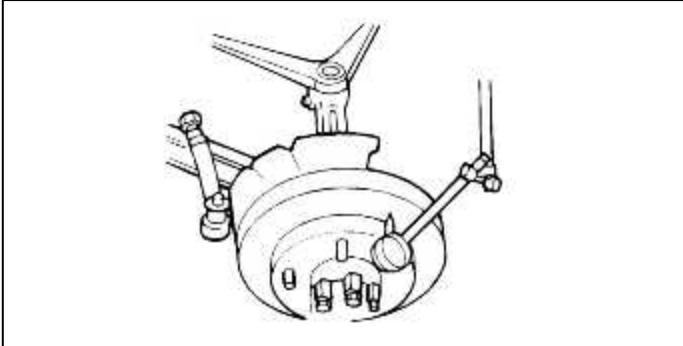
2. Install new oil seal and then install the wheel hub to the knuckle by pressing.

3. Apply grease to the wheel bearing and seal lip.

### **Driveshaft and axle > Front Axle Assembly > Repair procedures**

#### **INSPECTION**

1. Remove two bolts and remove brake caliper from brake rotor. Temporarily tie caliper to vehicle frame with wire.
2. Mount dial indicator with plunger zeroed against brake rotor at 4.7 inch (12 cm) from rotor center.



3. Turn rotor and read dial indicator for run out dimension.

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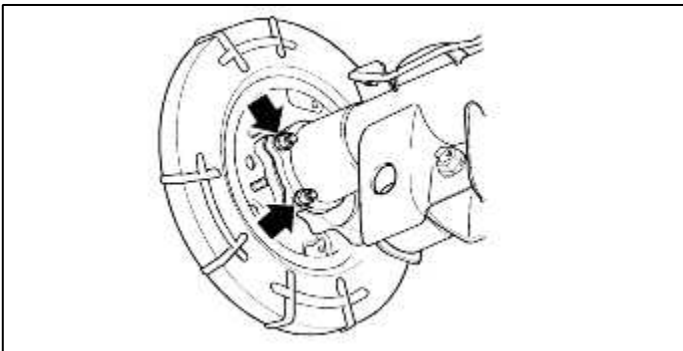
Run out not to exceed 0.0012 in (0.03 mm)

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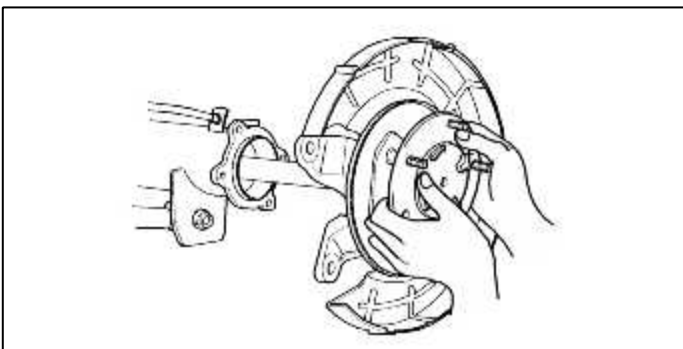
### **Driveshaft and axle > Rear Axle Assembly > Rear Axle Shaft Assembly > Repair procedures**

#### **REMOVAL**

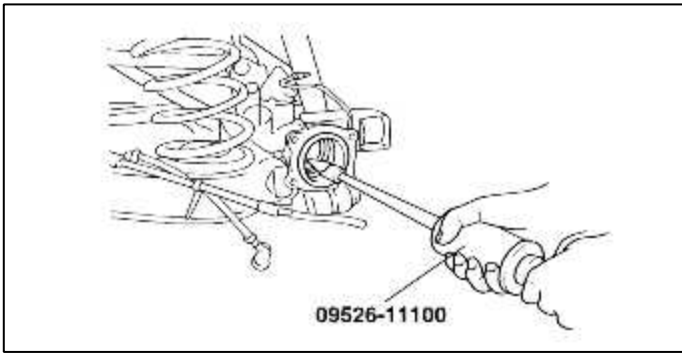
1. Remove the disk brake and parking brake assembly (Refer to "BR Group").
2. Remove the parking brake cable and speed sensor cable.
3. Remove the rear axle shaft mounting bolt.



4. Remove the rear axle shaft.

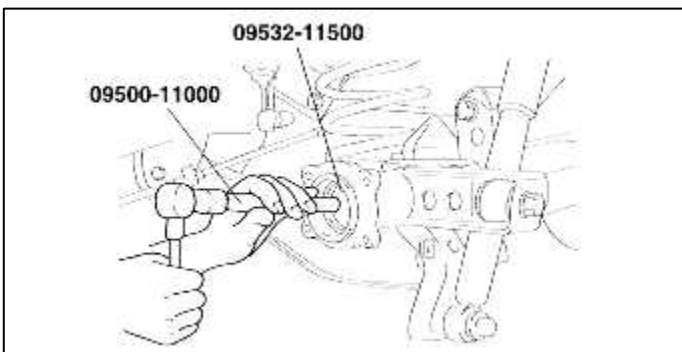


5. Using the special tool (09526-11100), remove the oil seal.



## INSTALLATION

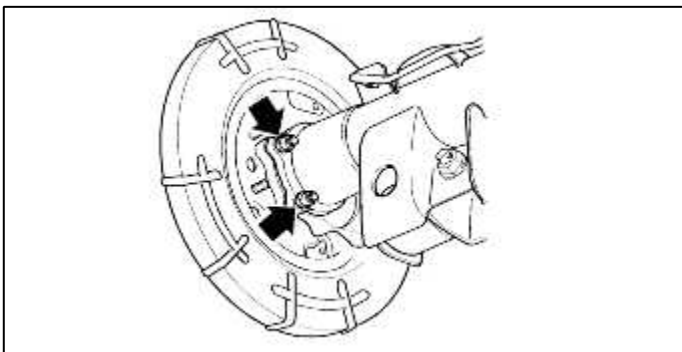
1. Installation is the reverse of removal.
2. Apply grease to the oil seal lip.
3. Using the special tools (09500-11000, 09532-11500), install the oil seal.



4. After installing the axle shaft, tighten the nut.

Tightening torque :

43-60 N·m (4.4-6.2 kg·m, 32-44 lb·ft)



5. Adjust the parking brake lever stroke.

## Driveshaft and axle > Rear Axle Assembly > Repair procedures

### SERVICE INSPECTION PROCEDURE

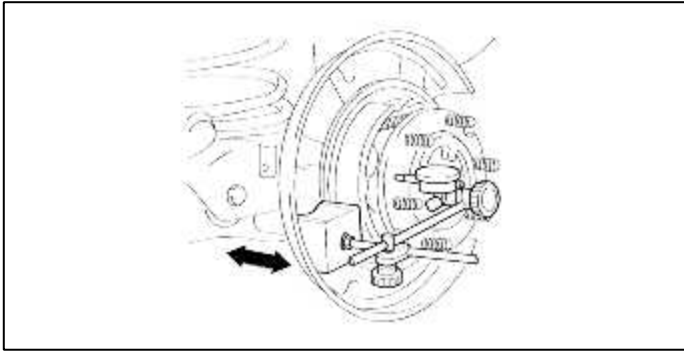
### AXLE SHAFT END PLAY CHECK

1. Measure the axle shaft end play using a dial indicator.

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Standard value : 0-0.05mm (0-0.002 in.)

---



2. If the axle shaft end play exceeds the standard value, replace the bearing with a new one.

#### GEAR OIL LEVEL CHECK

1. Remove the filler plug and check the quantity of oil in the differential carrier.
2. It is enough if oil is applied until the filler plug.

---

Specified gear oil :

Hipoid gear oil

Conventional differential

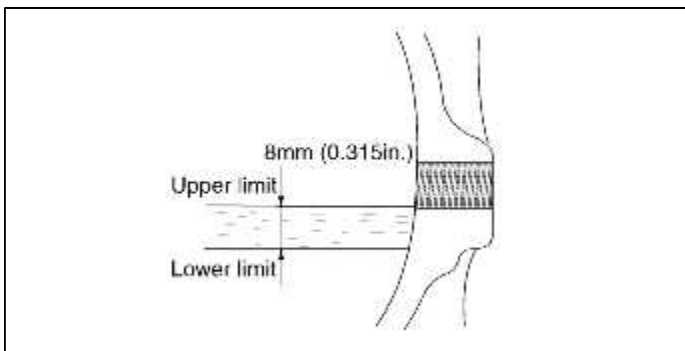
SAE90, API GL-5

With Limited Slip Differential

SAE85W90, API GL-5

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SPECIFIED GEAR OIL QUANTITY : 1.6 Liter

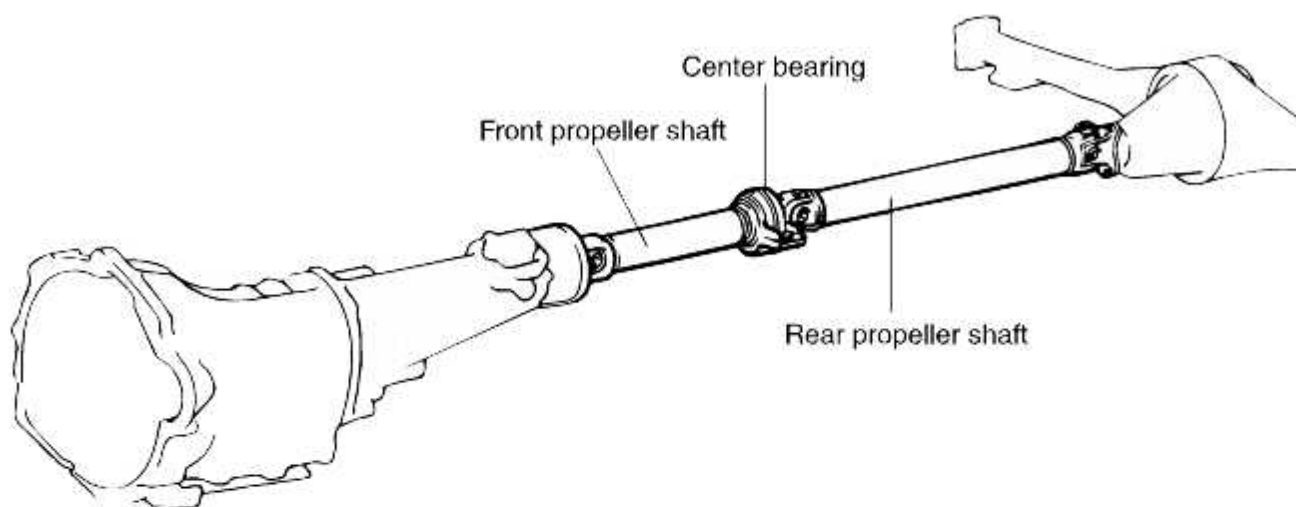


**Driveshaft and axle > Propeller Shaft Assembly > Propeller Shaft > Components and Components Location**

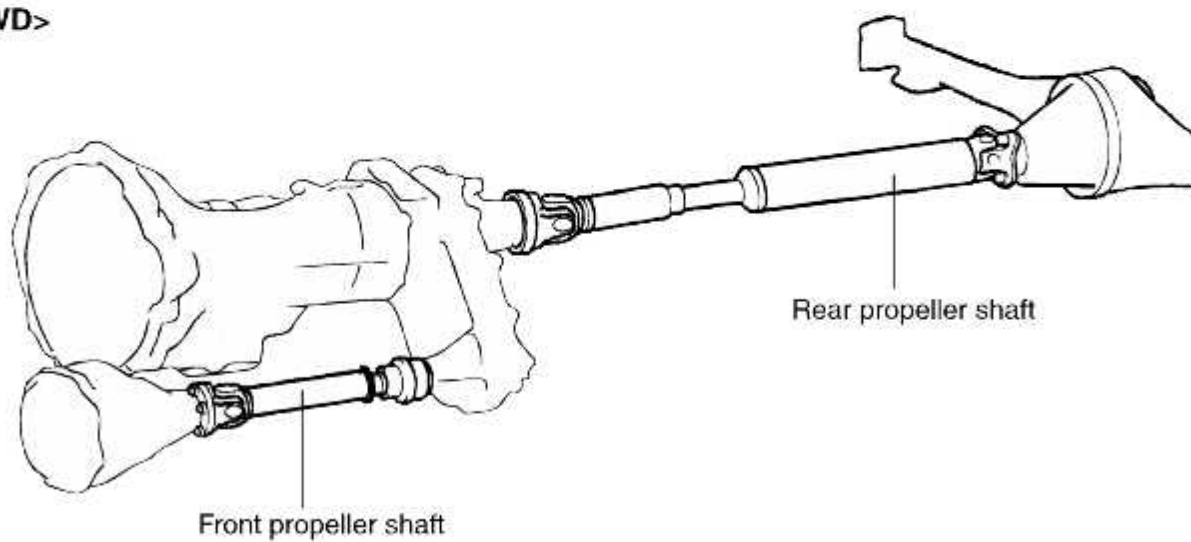
#### COMPONENTS



&lt;2WD&gt;

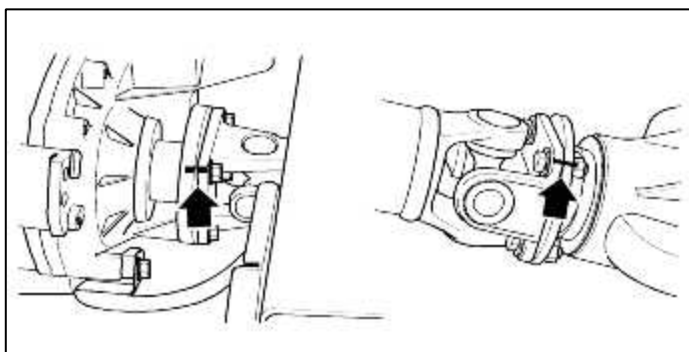


&lt;4WD&gt;

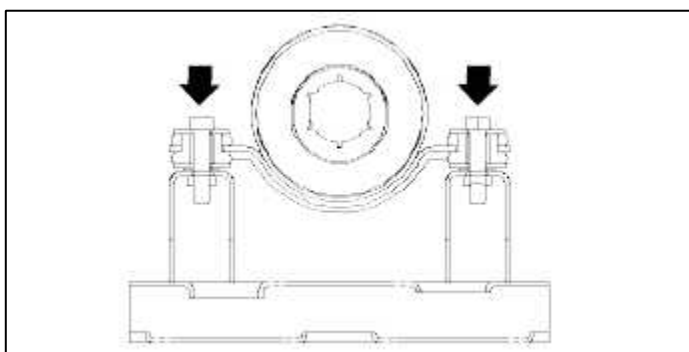
**Driveshaft and axle > Propeller Shaft Assembly > Propeller Shaft > Repair procedures****REMOVAL**

1. Raise and support vehicle.

2. Place index marks (reference marks) on the propeller shaft and their matching transfer case and differential input shafts.



3. Remove four bolts holding universal flange to transfer case (4WD).  
Remove bolts holding center bearing bracket (2WD).



4. Remove four bolts holding universal flange to differential.
5. Remove propeller shaft.

#### NOTE

- When removing the propeller shaft, be careful not to damage the dust cover or spline.

## INSTALLATION

1. Connect propeller shaft flange to companion flange on front differential (4WD).
  - A. Align index marks on the flange and connect the flanges with four bolts and nuts.
  - B. Tighten the bolts and nuts.

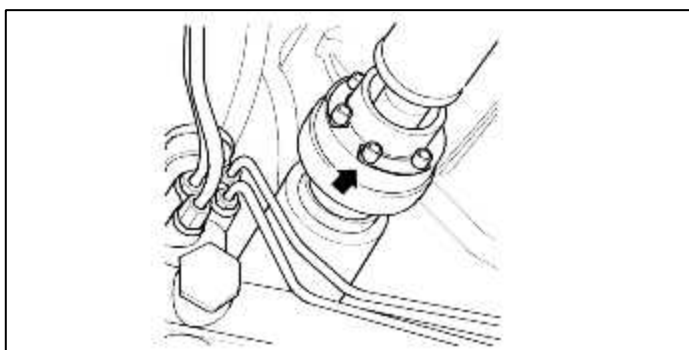
Tightening torque :

26-30 N·m (2.6-3.0 kg·m, 19-21 lb·ft)

- Full time 4WD

50-60 N·m (5.0-6.0 kg·m, 36-43 lb·ft)

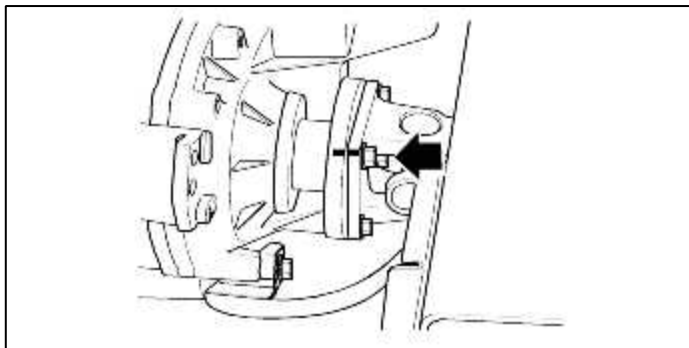
- Part time 4WD



2. Connect front propeller shaft flange to companion flange on transfer (4WD).
  - A. Align index marks on the flange and connect the flanges with four bolts and nuts.
  - B. Tighten the bolts.

Tightening torque :

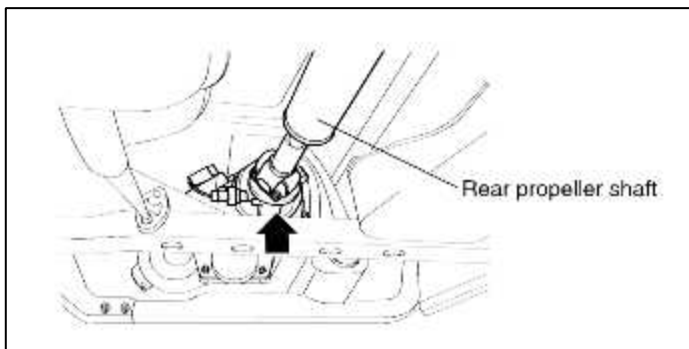
50-60 N·m (5.0-6.0 kg·m, 36-43 lb·ft)



3. Connect rear propeller shaft flange to companion flange on transfer. (4WD)
  - A. Align index marks on the flange and connect the flanges with four bolts and nuts.
  - B. Tighten the bolts.

Tightening torque :

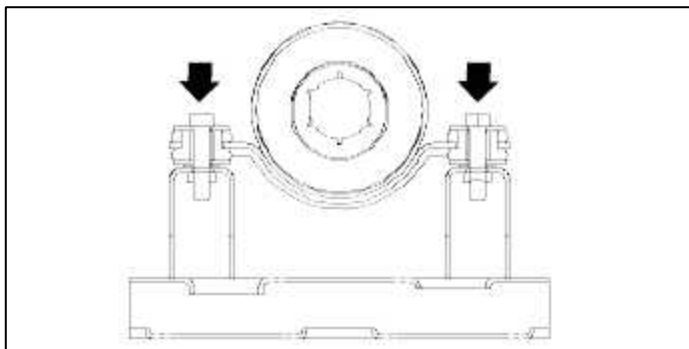
50-60 N·m (5.0-6.0 kg·m, 36-43 lb·ft)



4. Connect the propeller shaft spline to transmission (2WD)
  - A. Align index mark on the spline and then install the propeller shaft.
  - B. Tighten the bolts holding the center bearing bracket.

Tightening torque :

37-54 N·m (3.7-5.4 kg·m, 27-39 lb·ft)



**CAUTION**

- Be careful not to damage the dust cover of propeller shaft when installing the propeller shaft (2WD)

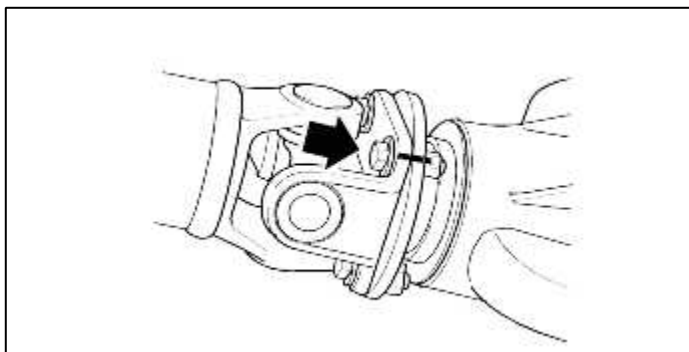
5. Connect propeller shaft flange to companion flange on rear differential.

A. Align index marks on the flange and connect the flange with four bolts and nuts.

B. Tighten the bolts and nuts.

Tightening torque :

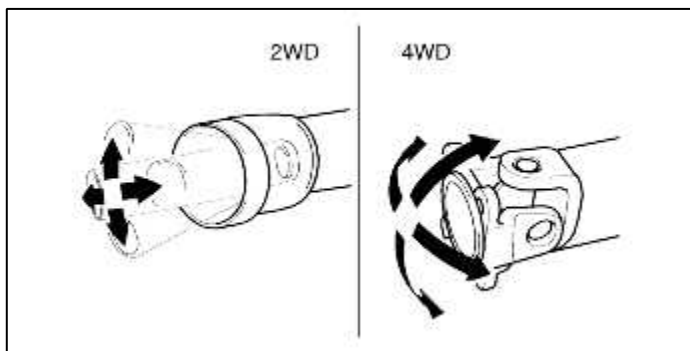
50-60 N·m (5.0-6.0 kg·m, 36-43 lb·ft)



6. After installing the propeller shaft fill the grease into the nipple until it comes out from the sleeve yoke plug hole.

**INSPECTION**

1. Check the sleeve yoke, center yoke and flange yoke for wear, damage or cracks.
2. Check the propeller shaft yokes for wear, damage or cracks.
3. Check the propeller shaft for bends, twisting or damage.
4. Check the universal joints for smooth operation in all directions.

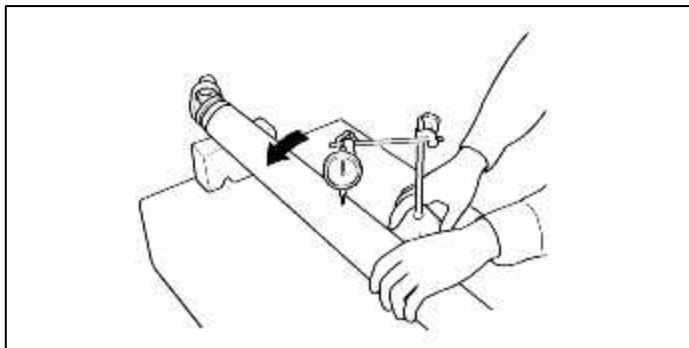


5. Check the center bearing for smooth movement (2WD).

6. Check the center bearing mounting rubber for damage or deterioration (4WD).

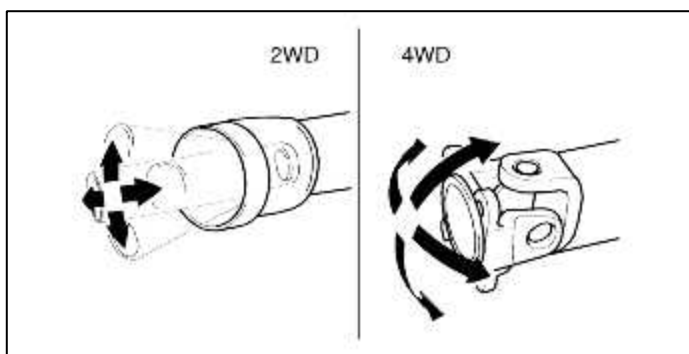
7. Measure the propeller shaft run out with a dial indicator.

Limit	Front	0.3 mm (0.012 in.) or less
	Rear	0.3 mm (0.012 in.) or less



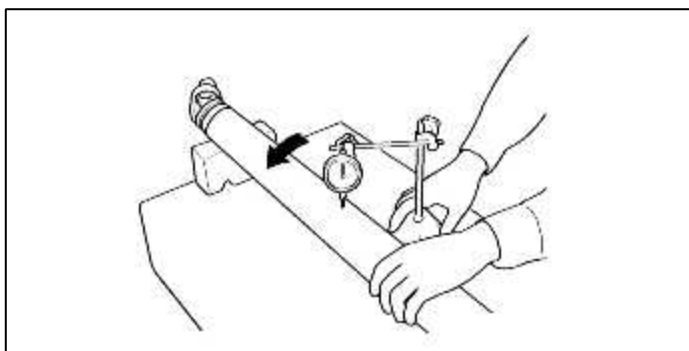
## INSPECTION

1. Check the sleeve yoke, center yoke and flange yoke for wear, damage or cracks.
2. Check the propeller shaft yokes for wear, damage or cracks.
3. Check the propeller shaft for bends, twisting or damage.
4. Check the universal joints for smooth operation in all directions.



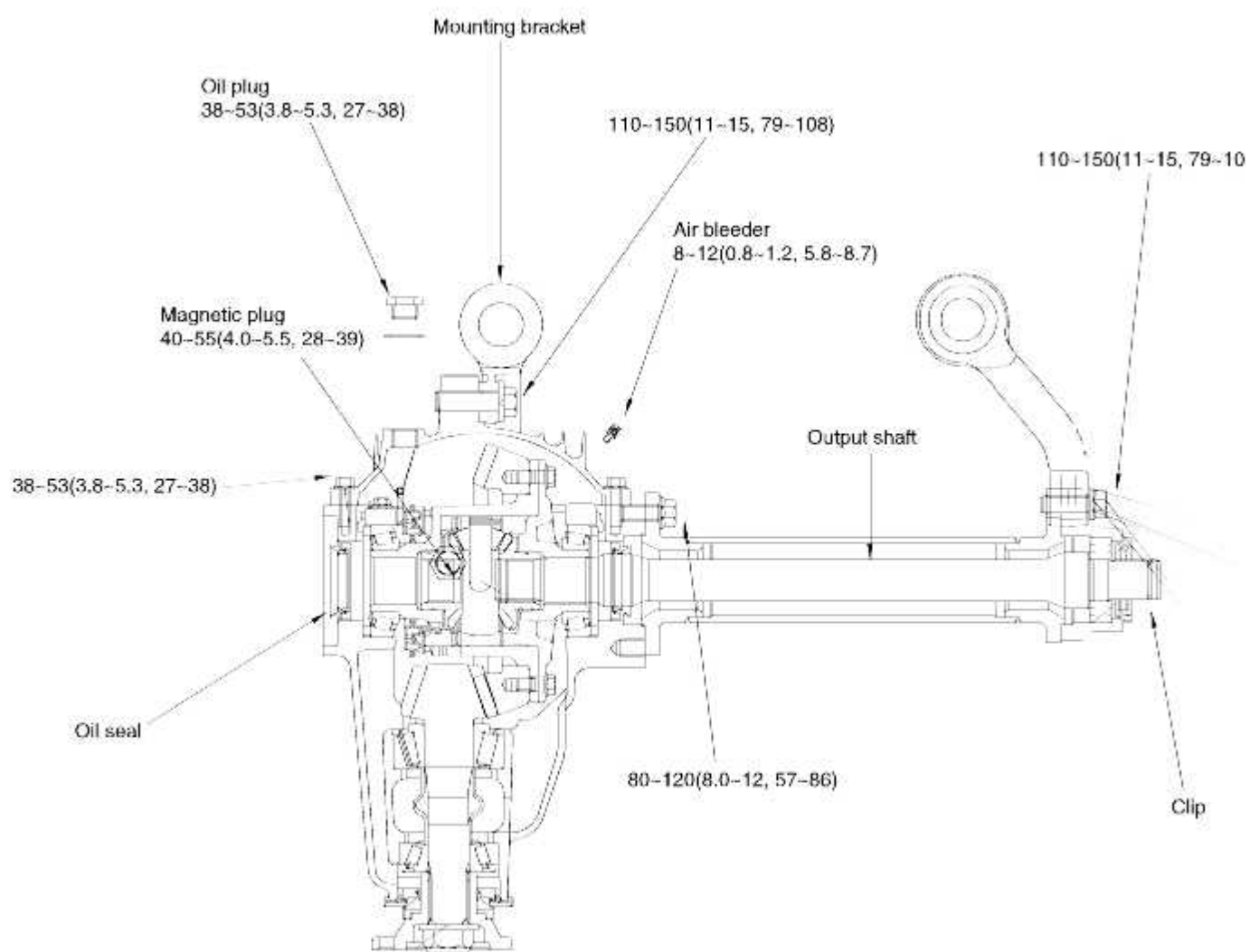
5. Check the center bearing for smooth movement (2WD).
6. Check the center bearing mounting rubber for damage or deterioration (4WD).
7. Measure the propeller shaft run out with a dial indicator.

Limit	Front	0.3 mm (0.012 in.) or less
	Rear	0.3 mm (0.012 in.) or less



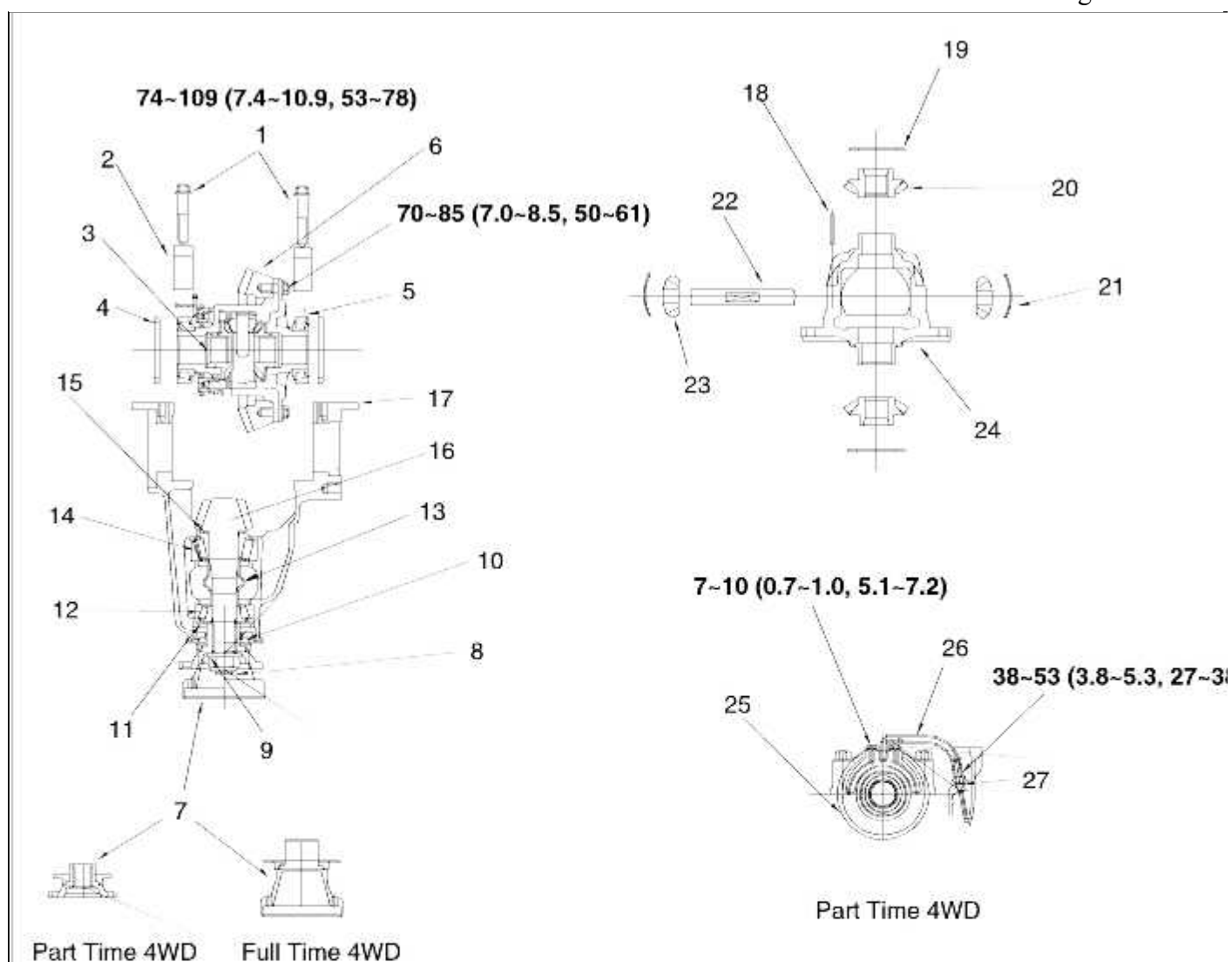
## Driveshaft and axle > Differential Carrier Assembly > Front Differential Carrier(4WD) > Components and Components Location

### Components



**TORQUE : N·m (kg·m, lb·ft)**

### Front differential components



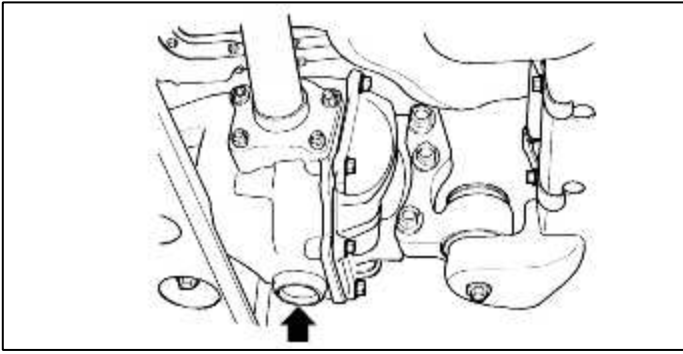
### TORQUE : N·m (kg·m, lb·ft)

1. Bearing cap bolt.	10. Oil seal	19. Thrust washer
2. Bearing cap	11. Oil slinger	20. Side gear
3. Differential assembly	12. Outer bearing	21. Washer
4. Spacer	13. Distance piece	22. Pinion shaft
5. Side bearing	14. Inner bearing	23. Pinion gear
6. Ring gear	15. Spacer	24. Case
7. Companion flange	16. Drive pinion	25. Actuator
8. Lock nut	17. Carrier assembly	26. Hose
9. Lock washer	18. Pin	27. Packing

## Driveshaft and axle > Differential Carrier Assembly > Front Differential Carrier(4WD) > Repair procedures

### Removal

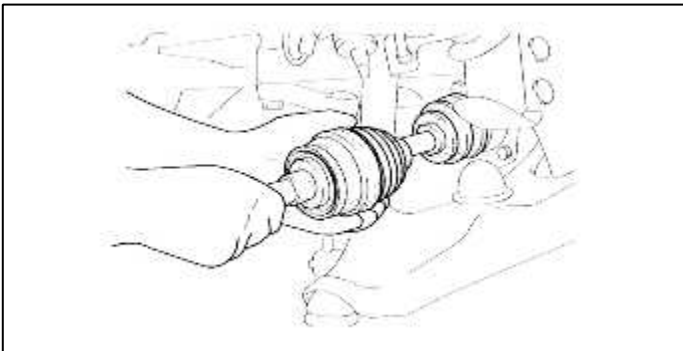
1. Drain oil.



2. Remove the drive shaft and the output shaft.

**CAUTION**

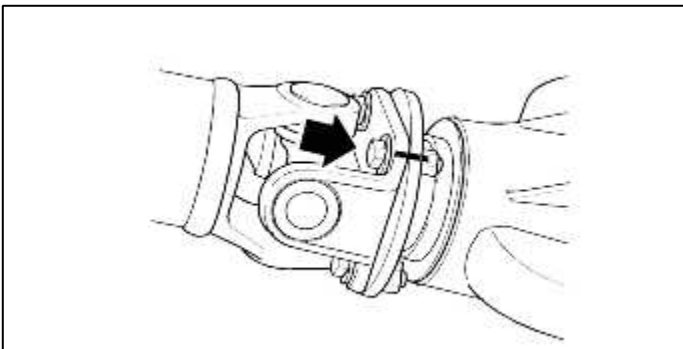
When removing the drive shaft, be careful not to damage the differential carrier oil seal by interference of spline part.



3. Remove the front propeller shaft.

**NOTE**

Make match mark on the flange yoke and differential companion flange to avoid any mistake when installing them again.

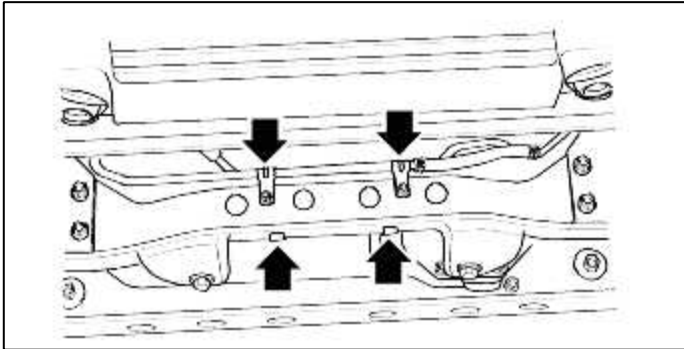




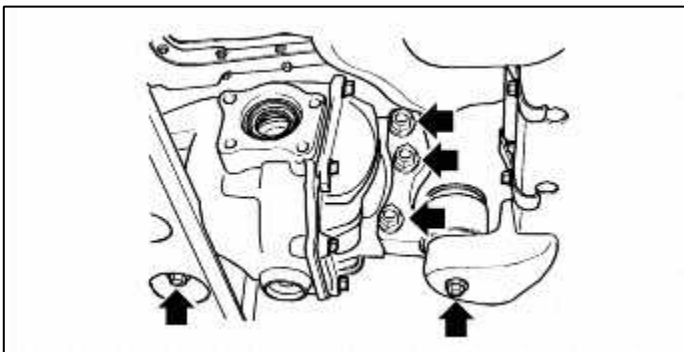
4. Remove the power steering tube mounting bracket.

Tightening torque :

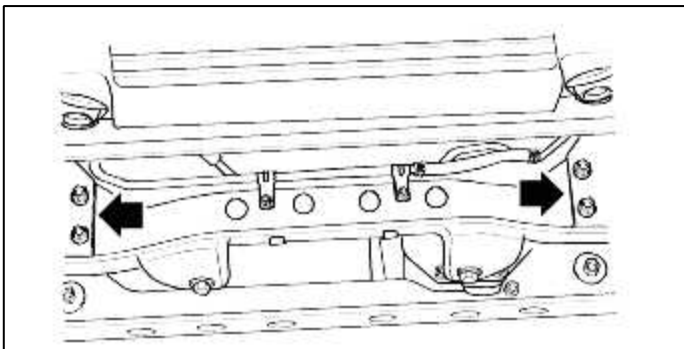
18-23 N·m (1.8-2.3 kg·m, 13-16 lb·ft)



5. Remove the differential mounting bracket.



6. Remove the front member.

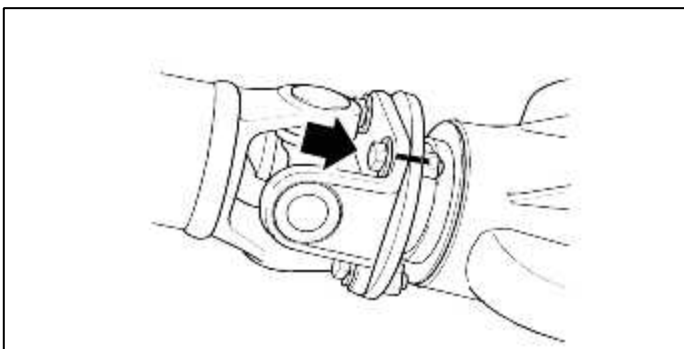


7. Remove the differential mounting bolt.

8. Remove the differential carrier.

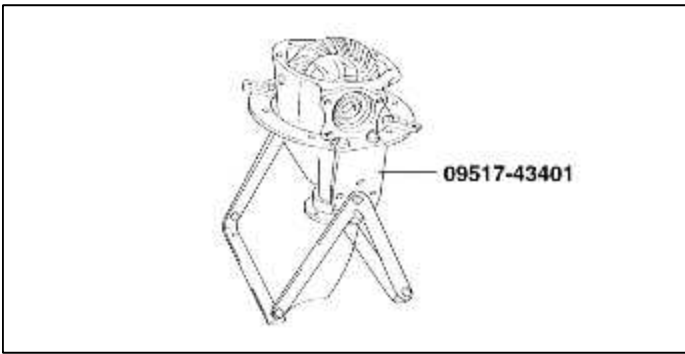
### Installation

1. Installation is the reverse of removal.
2. Align the matchmark on the flange yoke and the companion flange.  
Tighten the propeller shaft and the front differential carrier.



## INSPECTION BEFORE DISASSEMBLY

Mount the differential carrier on the special tool(09517-43401).



## FINAL DRIVE GEAR BACKLASH

1. Fix the drive gear so it cannot move and measure the final drive gearbacklash with a dial indicator.

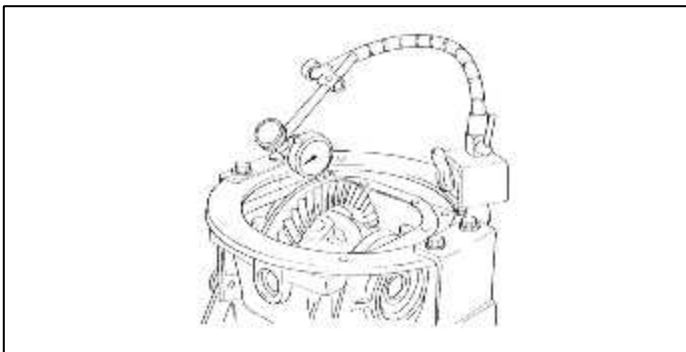
### NOTE

Measure at four points or more on the circumference of the drive gear.

---

Standard value : 0.09-0.11mm (0.0035-0.0043 in.)

---



## DRIVE GEAR RUNOUT

Check the back-face lash as follows:

1. Place a dial gauge on the back-face of the drive gear and measure the runout.

---

Limit : 0.05 mm (0.0020 in.)

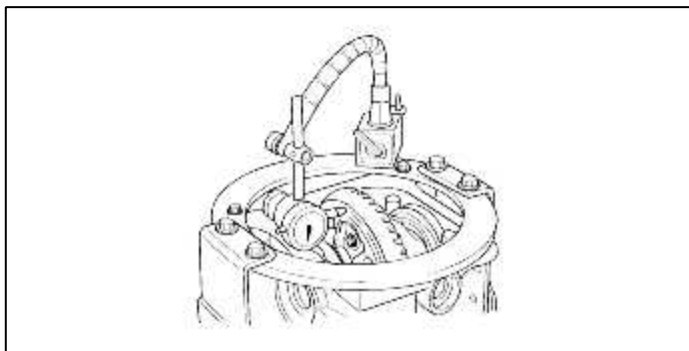
---

2. If the runout is beyond the limit, check that there are no foreign substances between the drive gear and differential case and, that the bolts fixing the drive gear are not loose.

3. If nothing is wrong in check (2), adjust the drive gear depth and remeasure.

**NOTE**

If these adjustments are impossible, replace the case or install a new drive gear/drive pinion as a set.



### DIFFERENTIAL GEAR BACKLASH

1. Fix the side gear with a wedge so it cannot move and measure the differential gear backlash with a dial indicator on the pinion gear.

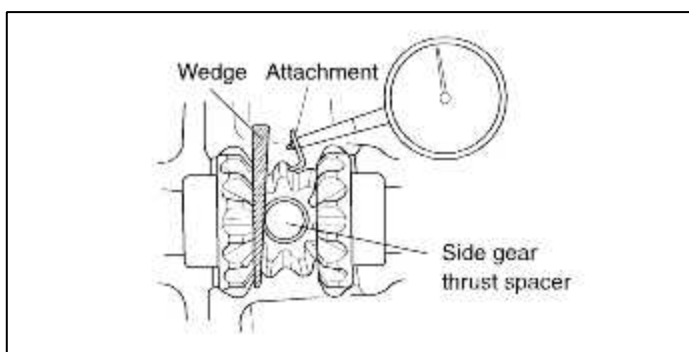
**NOTE**

Take the measurements at two places (4 places for LSD) on the pinion gear.

---

Standard value : 0-0.1 mm (0-0.0039 in.)

---



2. If the backlash exceeds the limit, adjust using side bearing spacers.

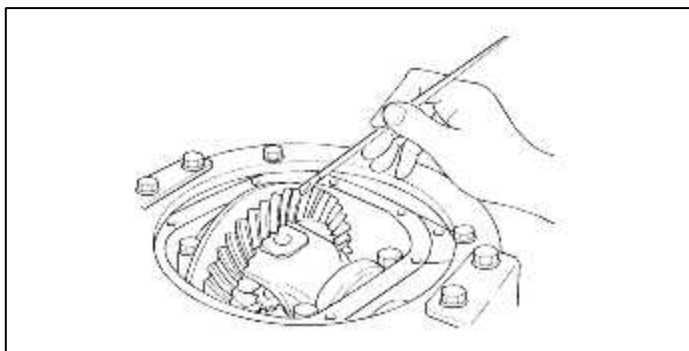
**NOTE**

If adjustment is impossible, replace the side gear and pinion gears as a set.

### FINAL DRIVE GEAR TOOTH CONTACT

Check the final drive gear tooth contact by following the steps below :

1. Apply the same amount of machine blue slightly to both surfaces of the drive gear teeth.

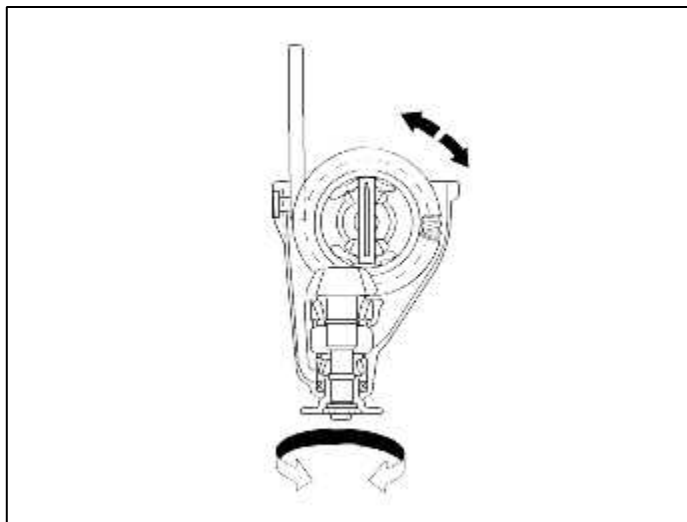


2. Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that some torque (approximately 25-30 kg-cm) is applied to the drive pinion.

**CAUTION**

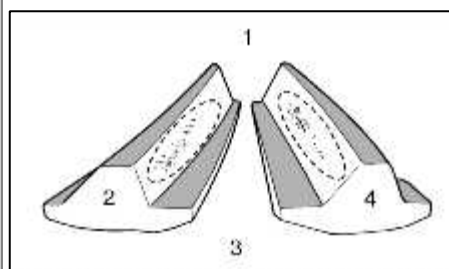
If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

3. Check the tooth contact pattern.



**Standard tooth contact pattern**

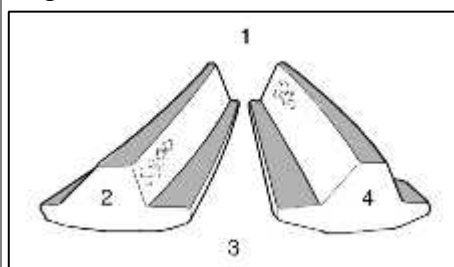
1. Narrow tooth side
2. >Drive-side tooth surface (the side receiving power during acceleration)
3. Wide tooth side
4. Coast-side tooth surface (the side receiving power during coast-down)



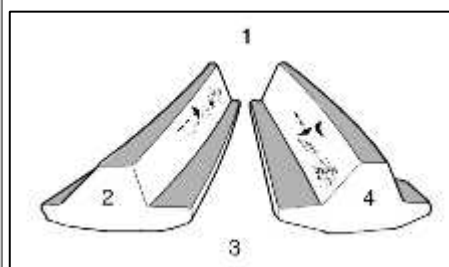
**Problem**

**Solution**

Tooth contact pattern resulting from excessive pinion height

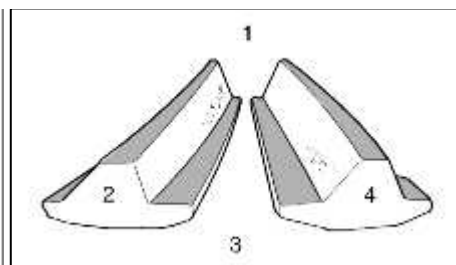


The drive pinion is positioned too far from the center of the drive gear.

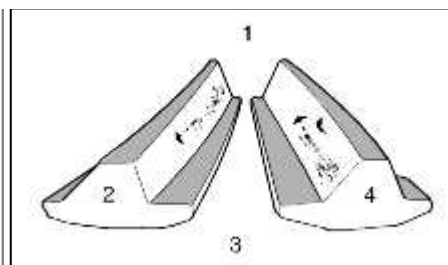


Increase the thickness of the pinion height adjusting shim, and position the drive pinion closer to the center of the drive gear.  
Also, for backlash adjustment, reposition the drive gear further from the drive pinion.

Tooth contact pattern resulting from insufficient pinion height



The drive pinion is positioned too close to the center of the drive gear.



Decrease the thickness of the pinion height adjusting shim, and position the drive pinion further from the center of the drive gear.  
Also, for backlash adjustment, reposition the drive gear closer to the drive pinion.

#### NOTE

- Tooth contact pattern is a method for judging the result of the adjustment of drive pinion height and final drive gear backlash. The adjustment of drive pinion height and final drive gear backlash should be repeated until the tooth contact patterns are similar to the standard tooth contact pattern.
- When you cannot obtain a correct pattern, the drive gear and drive pinion have exceeded their limits. Both gears should be replaced as a set.

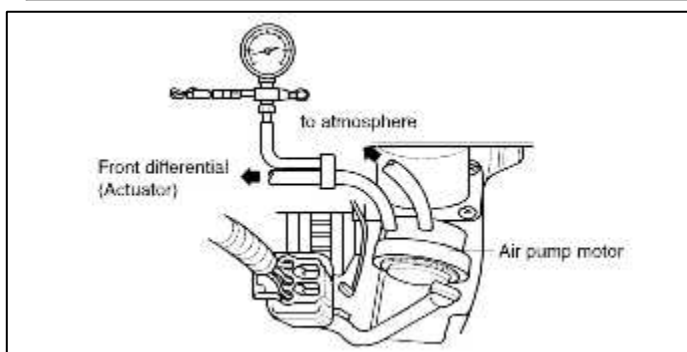
### 4WD CONTROL SYSTEM (PART TIME 4WD)

#### FUNCTION CHECK

1. Air pressure gauge is attached in between air hoses that connect differential (actuator) with air pump motor assy. Air pressure gauge adjustment screw shall be fastened until it stops ultimately. And make a blind stopper at air check sidebusing fuel hose etc.

#### CAUTION

- Air pressure gauge shall be installed by using 3-way union etc.
- Take heed not to snap or bend the piping hose.

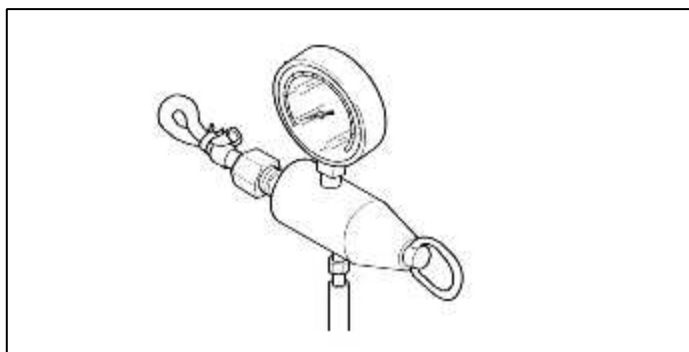


2. Turn the ignition switch on and shift the transfer lever 2H→4H.

3. Check that the motor starts to revolve in 1 second and stops when Air pressure gauge value displayed with in the specified value.

Specified pressure :

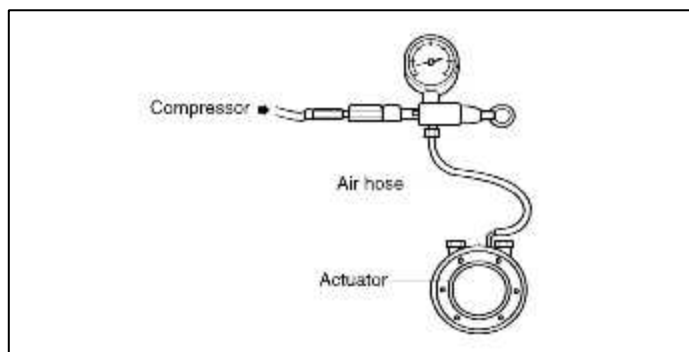
37-57 kPa (5.4-8.2 lb/in<sup>2</sup>, 0.38-0.58 kgf/cm<sup>2</sup>)



4. Check that if transfer lever is shifted to 2H then promptly Air pressure gauge value drops down.
5. Confirm that motor returns when Air pressure adjustment screw has been loosened to lower the gauge pressure value after motor had started to revolve by shifting transfer lever to 4H. And also check that the motor stops after several seconds since it started to run.

#### ACTUATOR CHECK

1. Detach air hose from air pump motor assy. and then attach Air pressure gauge as in figure.



2. Attach compressor air hose to Air pressure gauge and then set to specified pressure by fastening adjustment screw. Whence check that actuator is operated to affect the axle lock.

Specified pressure :

37 kPa (5.4 lb/in<sup>2</sup>, 0.38 kgf/cm<sup>2</sup>).

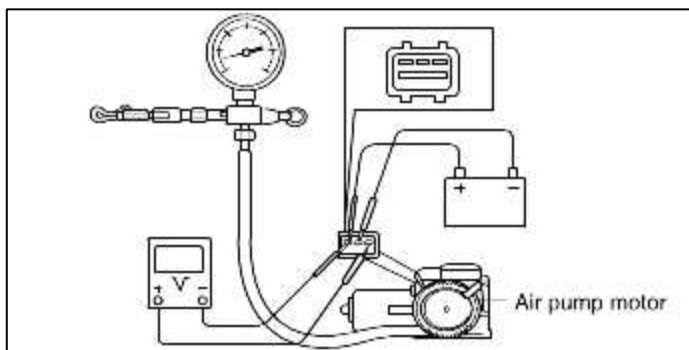
#### CAUTION

Take heed that there is potential for diaphragm breakage if pressure beyond 200 kPa (28 lb/in<sup>2</sup>, 2.0 kgf/cm<sup>2</sup>) is applied.

Do not use the air gun.

#### AIR PUMP MOTOR CHECK

1. Attach air pressure gauge, voltmeter and battery to air pump motor. as in figure. Air pressure gauge adjustment screw shall be fastened until it stops ultimately. And make a blind stopper at air check side by using fuel hose etc.



2. Confirm that motor runs when battery has been connected. And check that motor stops when returned to specified pressure.

Specified pressure :

37~57 kPa (5.4~8.2 lb/in<sup>2</sup>, 0.38~0.58 kgf/cm<sup>2</sup>).

#### CAUTION

Check also air leak.

3. Read voltmeter indication value so as check if it is within specified range.

Voltage :

about 0 V (when motor runs)

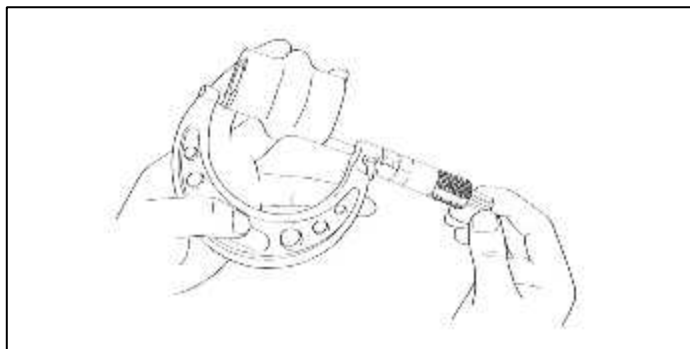
10~14 V (when motor stopped)

## INSPECTION

1. Check the companion flange for wear or damage.
2. Check the bearings for wear or discoloration.
3. Check the gear carrier for cracks.
4. Check the drive pinion and drive gear for wear or cracks.
5. Check the side gears, pinion gears and pinion shaft for wear or damage.
6. Check the side gear spline for wear or damage.
7. Check the length of the distance piece.

Standard length :

54.80-58.09 mm(2.16-2.21 in.)



## DISASSEMBLY

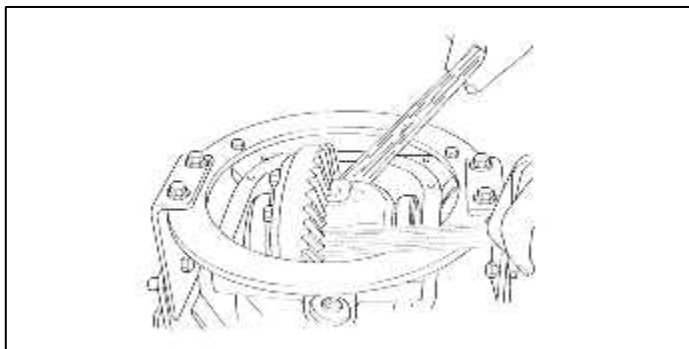
## 1. REMOVAL OF THE DIFFERENTIAL CASE ASSEMBLY

### CAUTION

Remove the differential case assembly slowly and carefully. Be careful so that the side bearing outer race is not dropped.

### NOTE

Keep the right and left side bearings separate so that they are not mixed during reassembly.

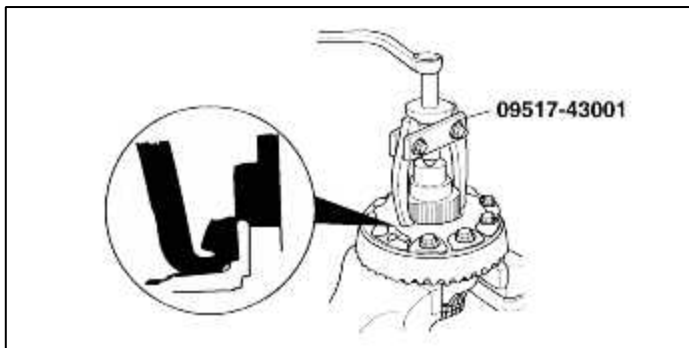


## 2. REMOVAL OF THE SIDE BEARING INNER RACES

Fit the nut on top of the differential case, and then use the special tool(09517-43001) to remove the side bearing inner race.

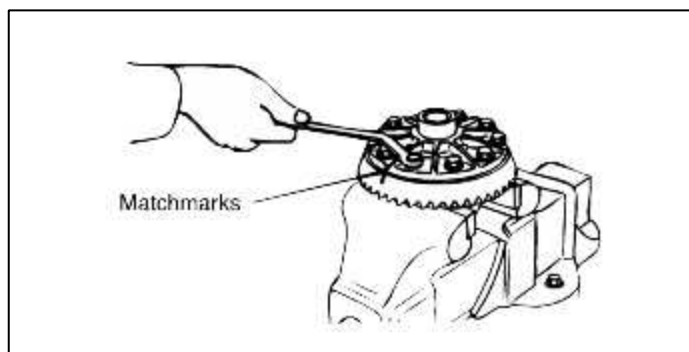
### NOTE

Attach the prongs of the special tool to the inner race of the side bearing through the notched section in the differential case.



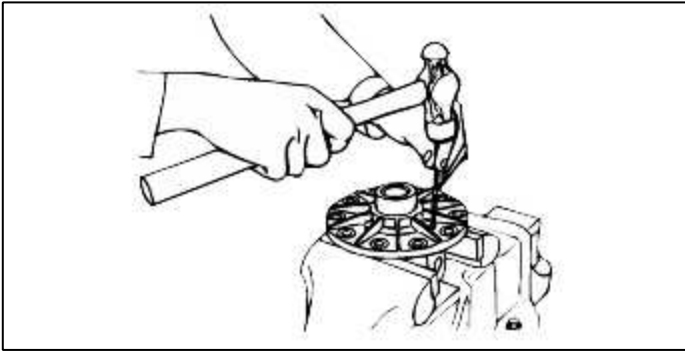
## 3. REMOVAL OF DRIVE GEAR

- A. Make the matchmarks to the differential case and the drive gear.
- B. Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.





#### 4. REMOVAL OF LOCK PIN (FOR CONVENTIONAL DIFFERENTIAL)



#### 5. REMOVAL OF SELF-LOCKING NUT



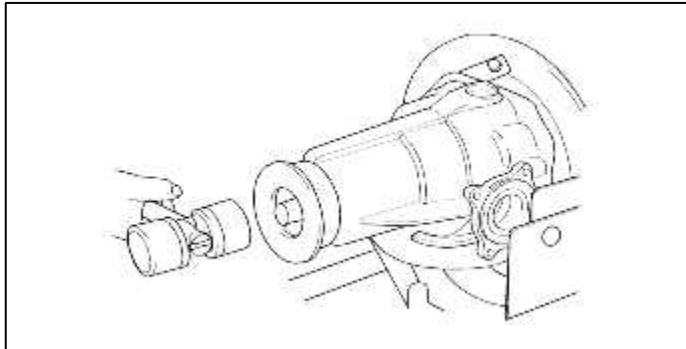
#### 6. REMOVAL OF DRIVE PINION

A. Make the matchmarks to the drive pinion and companion flange.

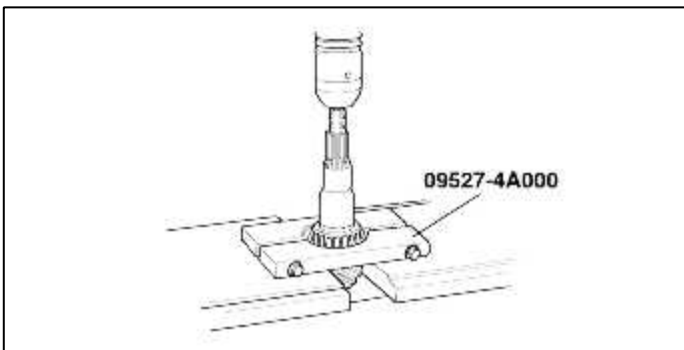
##### CAUTION

Matchmarks should not be made to the contact surfaces of the companion flange and the propeller shaft.

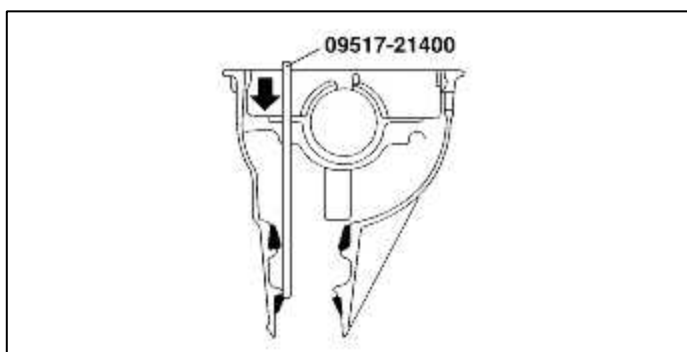
B. Drive out the drive pinion together with the drive pinion spacer and drive pinion front shims.



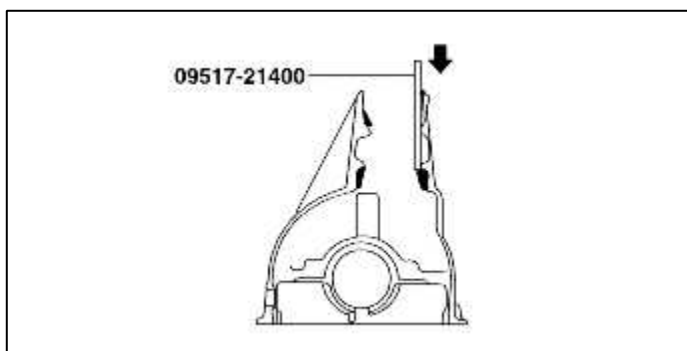
#### 7. REMOVAL OF DRIVE PINION INNER BEARING INNER RACE



## 8. REMOVAL OF OIL SEAL / DRIVE PINION OUTER BEARING INNER RACE / DRIVE PINION OUTER BEARING OUTER RACE

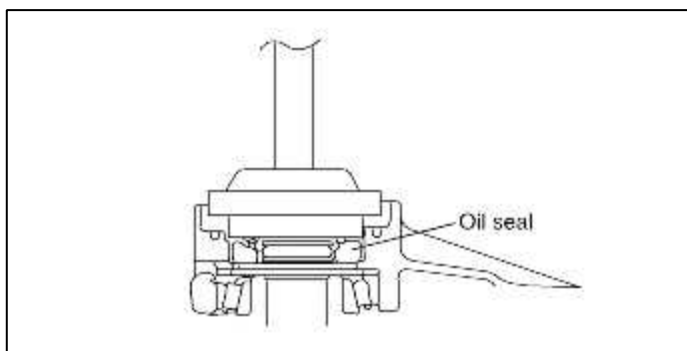


## 9. REMOVAL OF DRIVE PINION INNER BEARING OUTER RACE



## REASSEMBLY

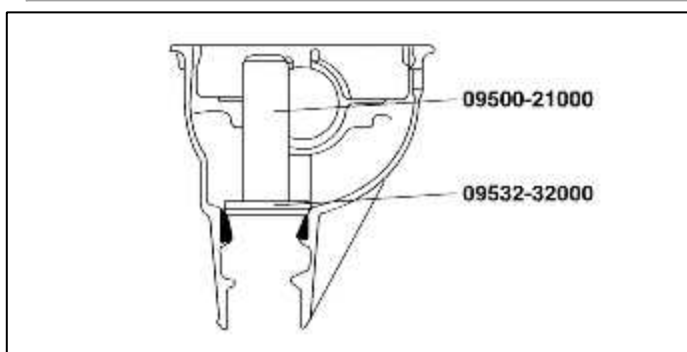
### 1. PRESS-FITTING OIL SEAL



### 2. DRIVE PINION OUTER BEARING OUTER RACE INSTALLATION

#### CAUTION

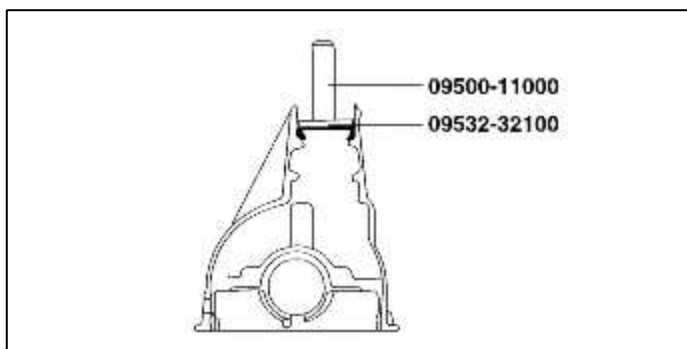
When press-fitting the outer race, do not incline it.



### 3. DRIVE PINION INNER BEARING OUTER RACE INSTALLATION

#### CAUTION

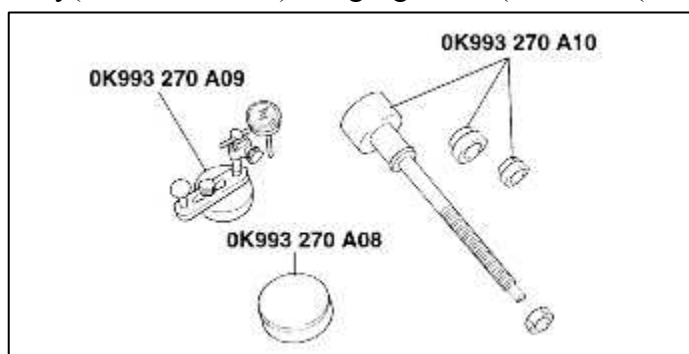
When press-fitting the outer race, do not incline it.



### 4. ADJUSTMENT OF PINION HEIGHT

Adjustment the drive pinion height by the following procedure.

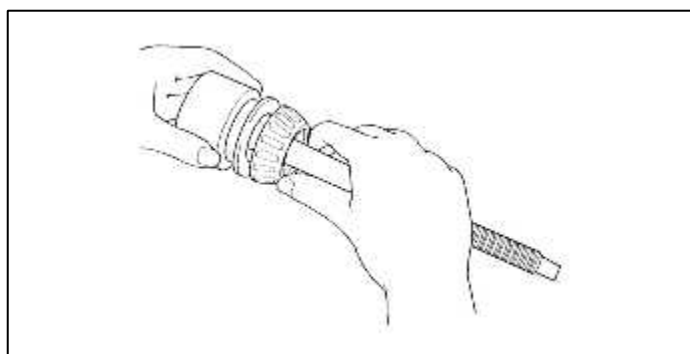
- (1) For assembly of pinion, use drive pinion model(0K993 270 A01), pinion height adjustment gauge body(0K993 270 A09) and gauge block(ht. 28 mm(1.102 in)).



- (2) Assemble spacer and inner bearing inner race to pinion model and fix it with O-ring.

#### NOTE

Use spacer disassembled.



- (3) Install pinion model assembly to carrier.
- (4) Assemble outer bearing, companion flange washer, and lock nut.

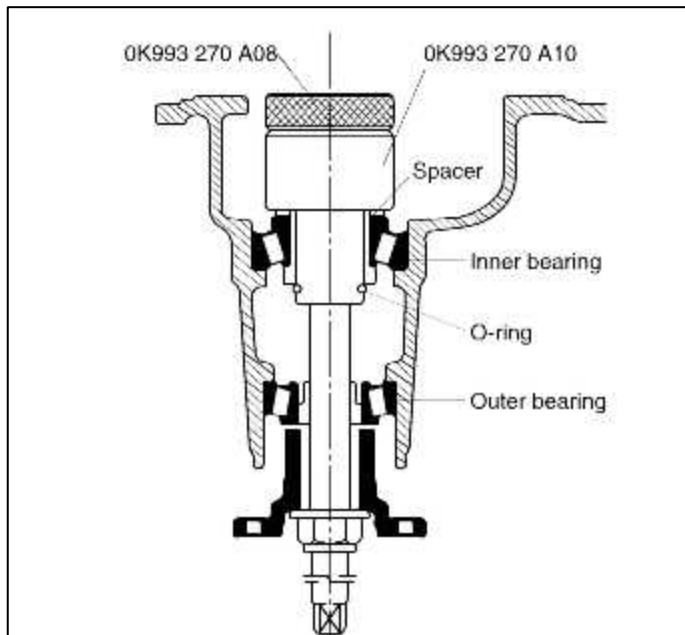
#### NOTE

Use washer and lock nut disassembled.

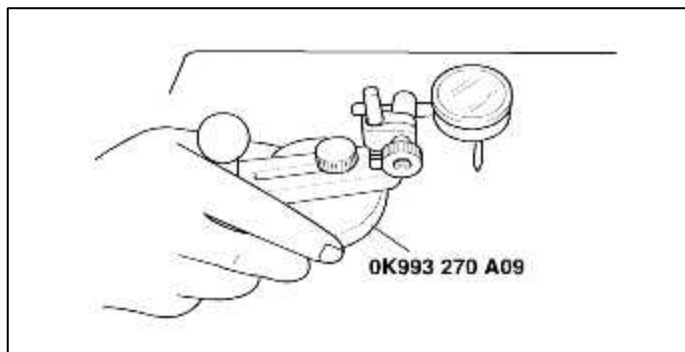
(5) Tighten lock nut.

**NOTE**

- Tighten to the extent the companion flange can be screwed by hand.



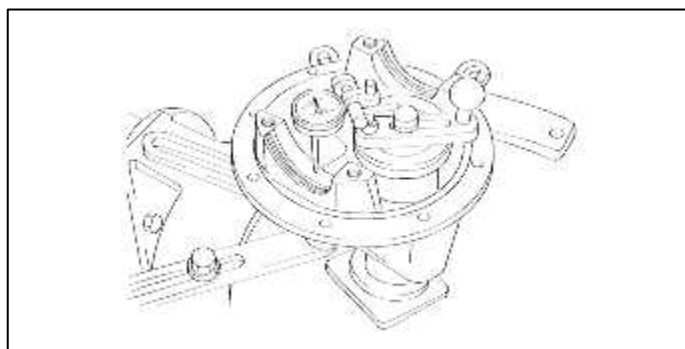
(6) Put pinion height adjusting gauge body at right angle and adjust it to 0.



(7) Put pinion height adjusting gauge body and gauge block to the upper side of pinion model.

(8) Dial gauge needle should be placed at the lowest part of side bearing.

(9) Measure minimum positions of both sides (LH, RH).



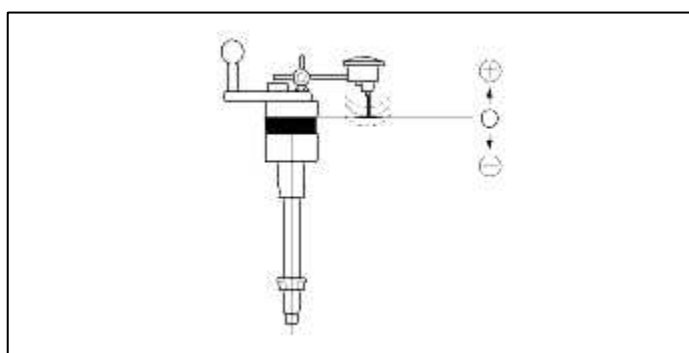
(10) Add both values and divide it by 2.

- (11) If the value of the above step 10 is not within specification, use new spacer adding the values to current spacer.

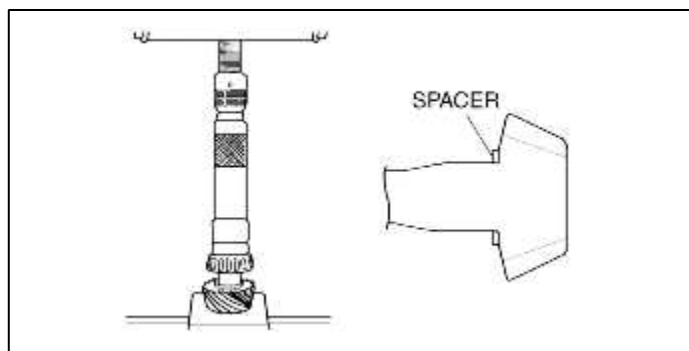
Standard clearance :

-0.025~0.025 mm (-0.001~0.001 in)

MARK	THICKNESS	MARK	THICKNESS
08	3.08(0.1212)	29	3.29(0.1259)
11	3.11(0.1224)	32	3.32(0.1307)
14	3.14(0.1236)	35	3.35(0.1318)
17	3.17(0.1248)	38	3.38(0.1330)
20	3.20(0.1259)	41	3.41(0.1342)
23	3.23(0.1271)	44	3.44(0.1354)
26	3.26(0.1283)	47	3.47(0.1366)



#### 5. Adjustment of drive pinion preload.



- (1) Install spacer.
- (2) Push inner bearing in using SST.

#### NOTE

- Keep pressuring until the sudden increase of necessary power.
- Place the spacer for adjusting pinion height, ensuring exact direction of installation.

- (3) Install distance piece.
- (4) Push outer bearing in using SST.
- (5) Install drive pinion assembly.

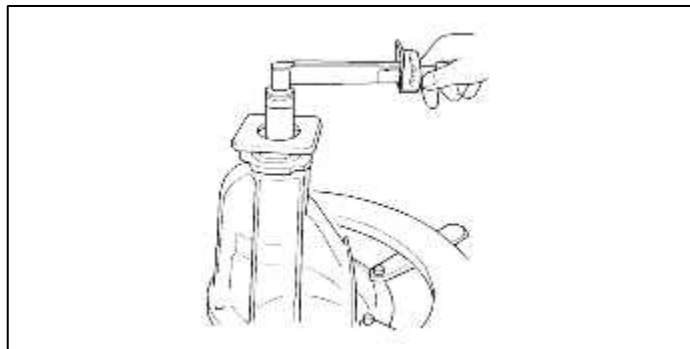
- (6) Install companion flange and tighten lock nut.

Tightening torque :

127-284 N·m (13-29 kg·m, 94-210 lb·ft)

**NOTE**

Do not install oil seal.



- (7) Turn companion flange by hand so that bearing be put at the right place.  
 (8) Measure preload of drive pinion. If the result is not within specification, use new distance piece and measure again.

Preload :

127-176 N·m (13-18 kg·m, 94-130 lb·ft)

- (9) Remove the lock nut and then install the oil seal.  
 (10) >Install the companion flange and tighten lock nut.

Tightening torque :

127-284 N·m (13-29 kg·m, 94-210 lb·ft)

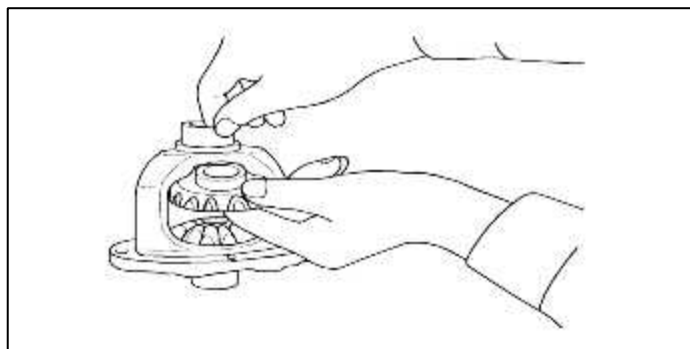
## 6. ADJUSTMENT OF DIFFERENTIAL GEAR BACKLASH

Adjust the differential gear backlash according to the following procedures :

- (1) Assemble the side gears, side gear spacers, pinion gears, and pinion washers into the differential case.  
 (2) Temporarily install the pinion shaft.

**NOTE**

Do not install the lock pin yet.



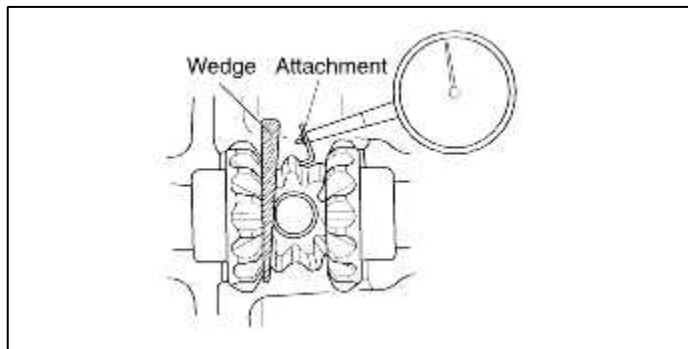
- (3) Insert a wedge in the side gear and measure the differential gear backlash with a dial indicator on the pinion gear.

**NOTE**

Measure both pinion gears separately.

Standard value : 0-0.1 mm (0-0.0039 in.)

Limit : 0.2 mm (0.008 in.)



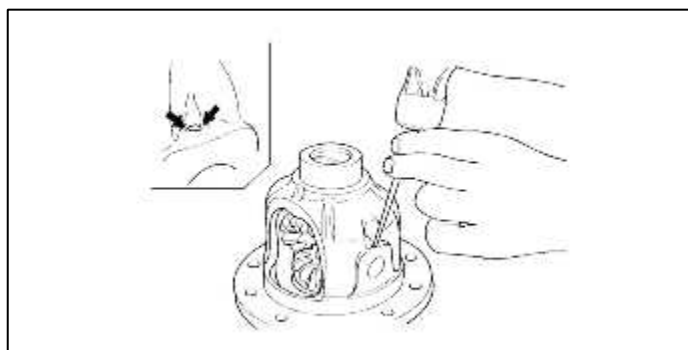
- (4) If the differential gear backlash exceeds the limit, adjust the backlash by selecting thicker side gear thrust spacers.
- (5) Measure the differential gear backlash once again, and confirm that it is within the limit.

**NOTE**

- After adjustment, check that the backlash is within the limit and the differential gear rotates smoothly.
- When adjustment is impossible, replace the side gear and the pinion gear as a set.

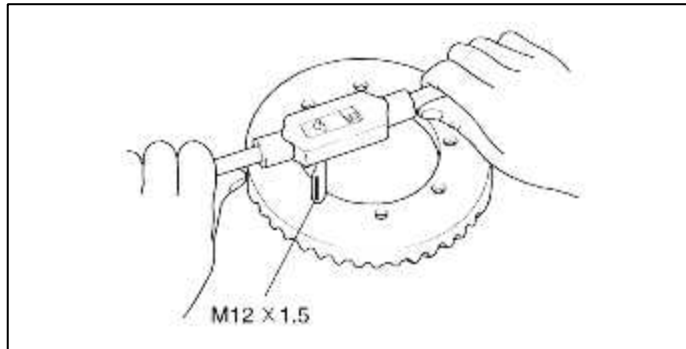
## 7. INSTALLATION OF THE LOCK PIN

- (1) Align the pinion shaft lock pin hole with the differential case lock pin hole, and drive in the lock pin.
- (2) Fix the lock pin in place by staking two points around the lock pin hole with a punch.



## 8. INSTALLATION OF THE DRIVE GEAR

- (1) Clean the drive gear attaching bolts.
- (2) Remove the adhesive on the threaded holes of the drive gear use a tap (M10 x 1.25), and then clean the threaded holes with compressed air.

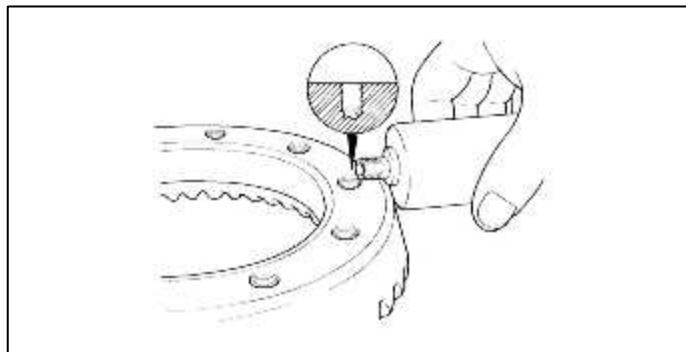


- (3) Apply the specified adhesive to the threaded holes of the drive gear.

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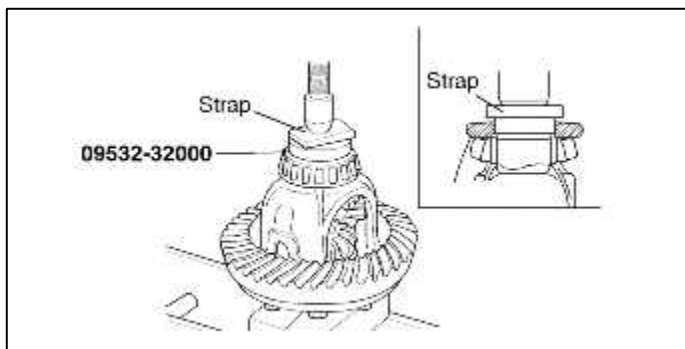
Specified adhesive : LOCTITE #262 or equivalent

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- (4) Install the drive gear in the differential case with the matchmarks properly aligned. Tighten the bolts to the specified torque in a diagonal sequence.

## 9. PRESS THE SIDE BEARING INNER RACE

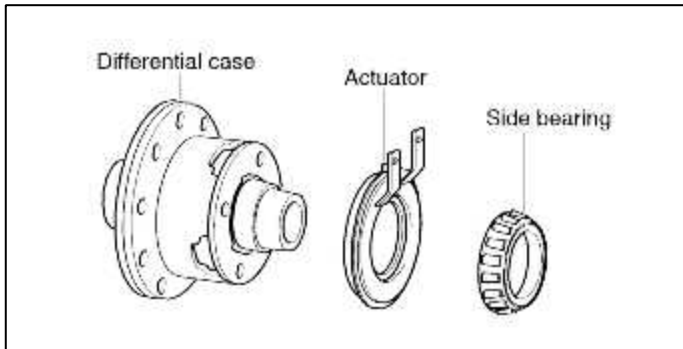




## 10. Attach actuator at differential case RH side as figure

**CAUTION**

Take heed of actuator direction.



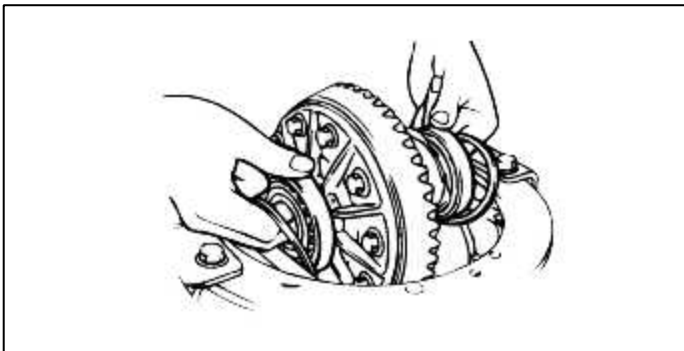
## 11. ADJUSTMENT OF FINAL DRIVE GEAR BACKLASH

Adjust the final drive gear backlash according to the following procedures :

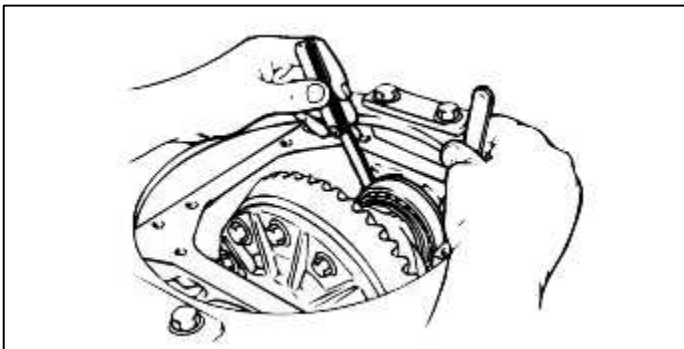
- (1) Install side bearing spacers which are thinner than those removed, to the side bearing outer races, and then mount the differential case assembly into the gear carrier.

**NOTE**

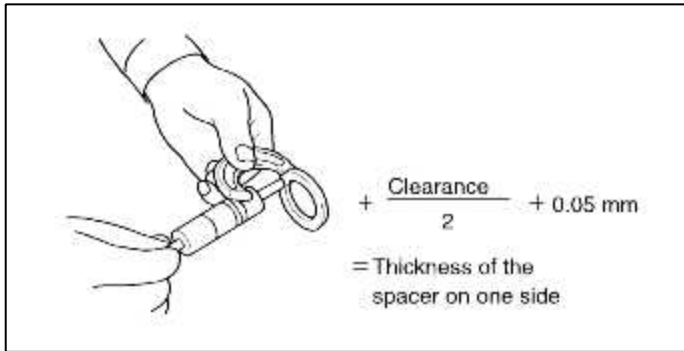
Select side bearing spacers with the same thickness for both the drive pinion side and the drive gear side.



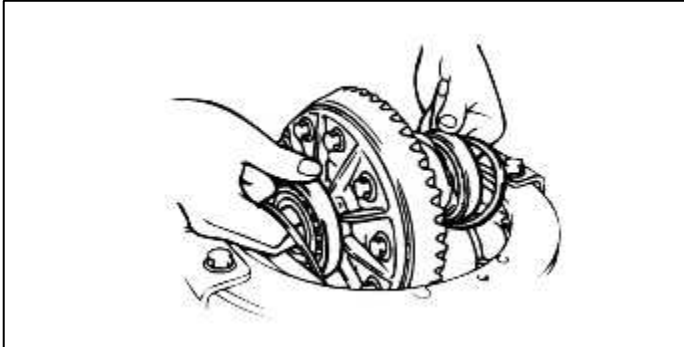
- (2) Push the differential case to one side, and measure the clearance between the gear carrier and the side bearing with a feeler gauge.



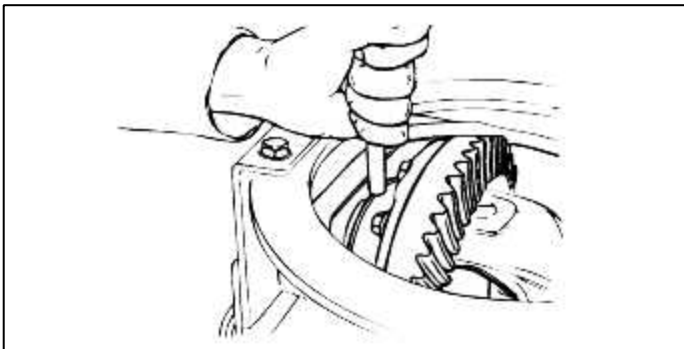
- (3) Select two pairs of spacers which correspond to the value calculated according to the expression in the illustration. Install one pair each to the drive pinion side and the drive gear side.



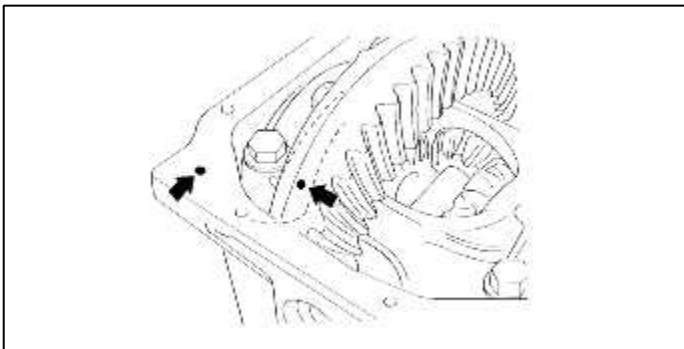
- (4) Install the side bearing spacers and differential case assembly, as shown in the illustration, to the gear carrier.



- (5) Tap the side bearing spacers with a brass bar to fit them to the side bearing outer race.



- (6) Align the matchmarks on the gear carrier and the bearing cap and tighten the bearing cap.

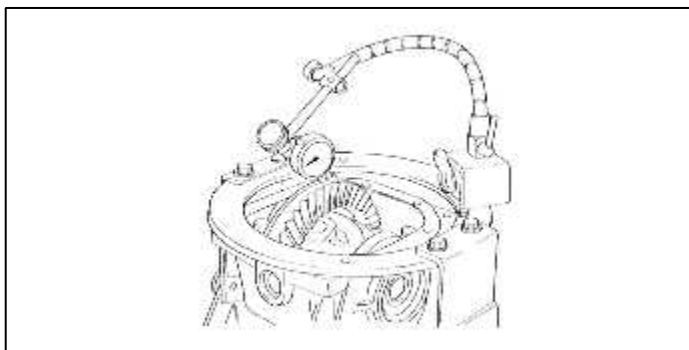


- (7) With the drive pinion locked in place, measure the final drive gear backlash with a dial indicator on the drive gear.

**NOTE**

Measure at four points or more on the circumference of the drive gear.

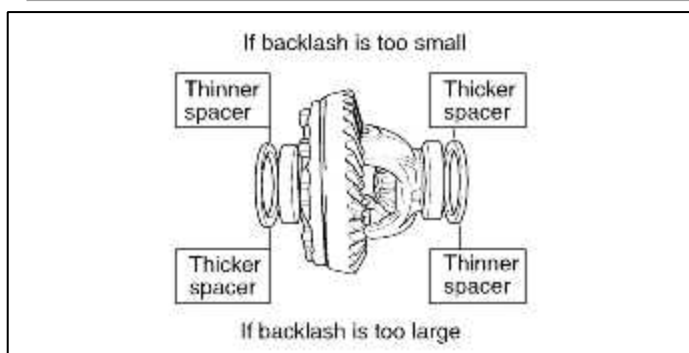
Standard value : 0.09-0.11 mm (0.0035-0.0043 in.)



- (8) Change the side bearing spacers as illustrated and then adjust the final drive gear backlash between the drive gear and the drive pinion.

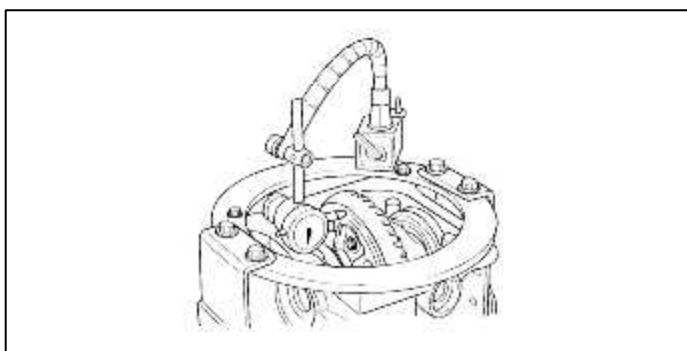
**NOTE**

When increasing the number of side bearing spacers, use the same number for each and as few as possible.



- (9) Check the drive gear and drive pinion for tooth contact. If poor contact is evident, adjust again.  
 (10) Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

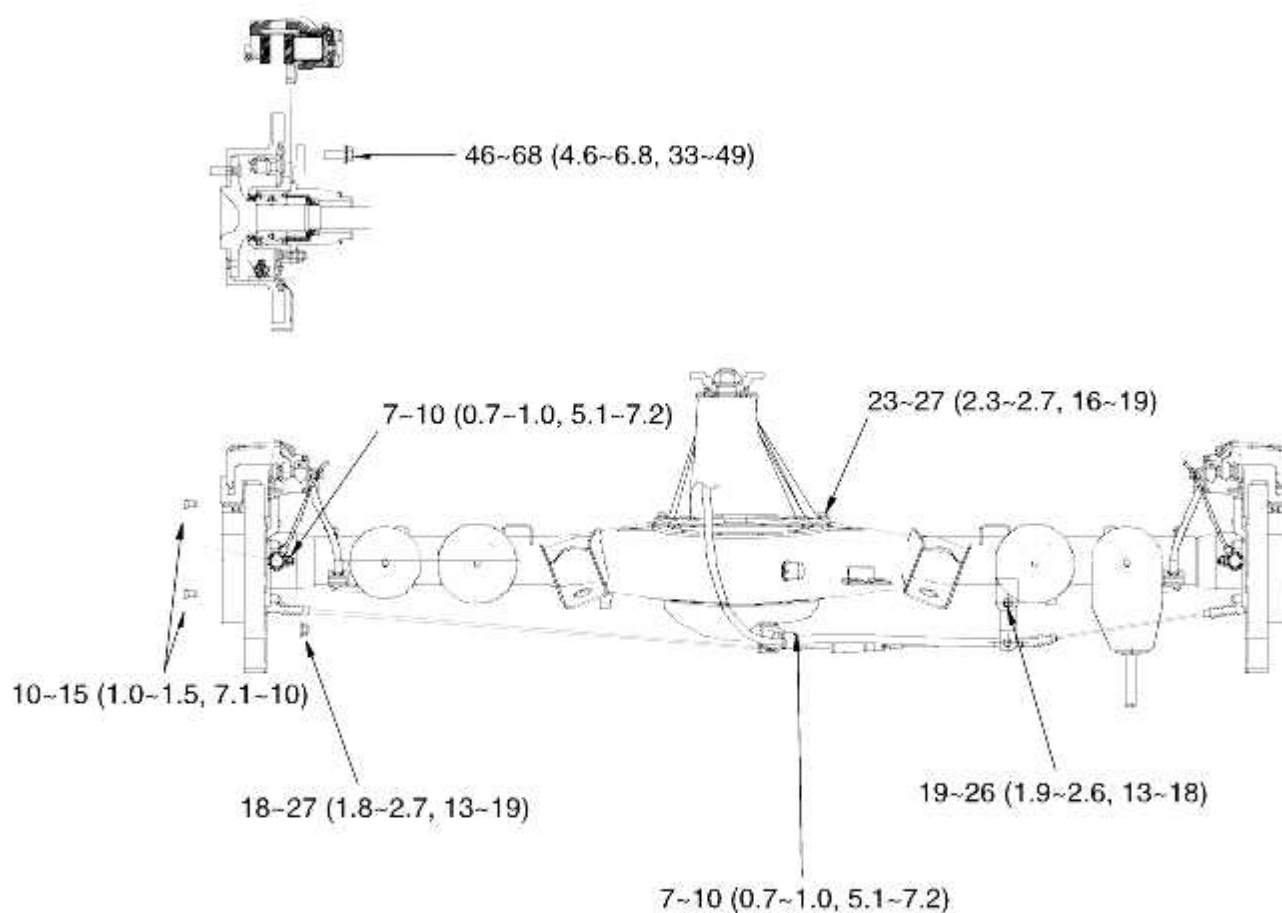
Limit : 0.05 mm (0.002 in.)



- (11) If the drive gear runout exceeds the limit, reinstall by changing the position of the drive gear and differential case, and remeasure.

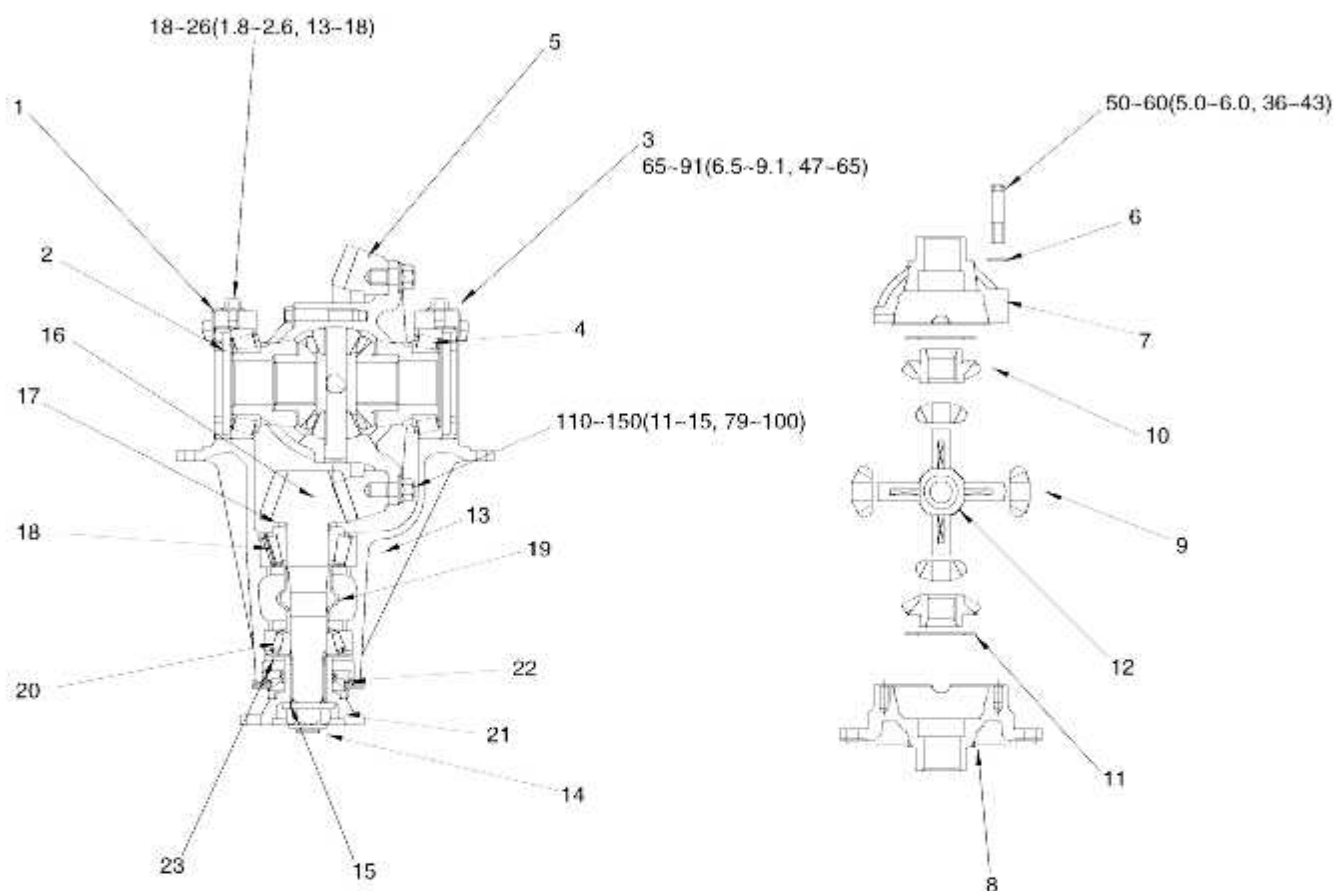
# Driveshaft and axle > Differential Carrier Assembly > Rear Differential Carrier > Components and Components Location

## COMPONENTS



Torque : N·m(kg-m, lb-ft)

## REAR DIFFERENTIAL COMPONENTS



### TORQUE : N·m (kg·m, lb·ft)

1. Lock plate	9. Pinion gear	17. Spacer
2. Side bearing nut	10. Side gear	18. Inner bearing
3. Bearing cap	11. Side gear thrust washer	19. Distance piece
4. Side bearing	12. Spider	20. Outer bearing
5. Ring gear	13. Differential carrier case	21. Companion flange
6. Washer	14. Lock nut	22. Oil seal
7. Differential upper case	15. Lock washer	23. Oil slinger
8. Differential lower case	16. Drive pinion	

### Driveshaft and axle > Differential Carrier Assembly > Rear Differential Carrier > Repair procedures

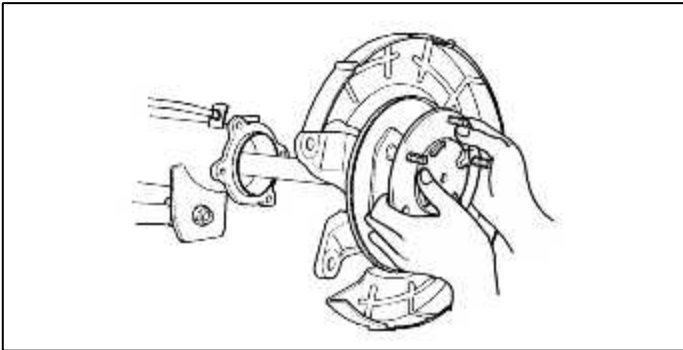
#### REMOVAL

1. Drain the differential gear oil.
2. Remove the rear disk brake.
3. Remove the parking brake and cable.
4. Remove the stabilizer bar.

5. Pull out the rear axle shaft.

**CAUTION**

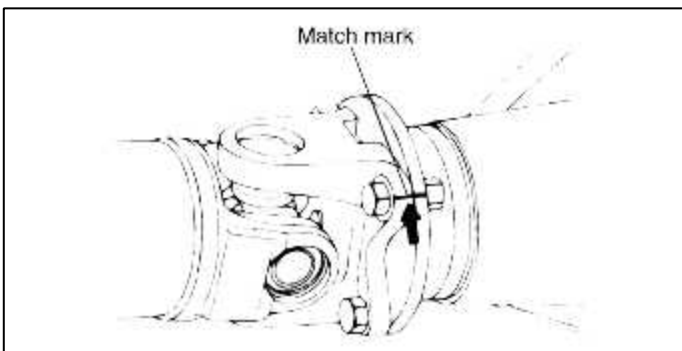
Be careful not to damage the oil seal when pulling axle shaft.



6. After marking the match mark on the flange yoke of the rear propeller shaft and the companion flange of the differential case, remove the rear propeller shaft assembly.

**CAUTION**

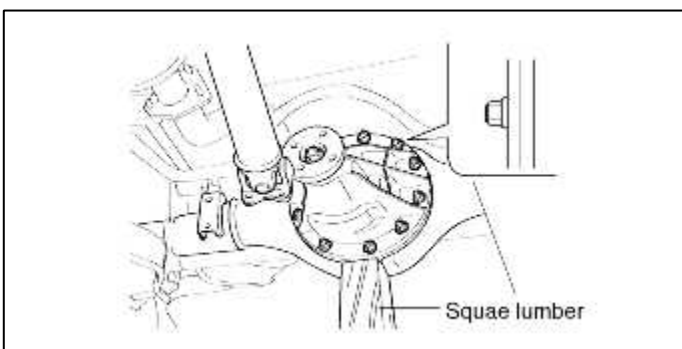
Suspend the propeller shaft from the body with wire, etc.



7. Remove the attaching nuts and strike the lower part of differential carrier assembly with a piece of times several times to loosen, then remove the differential carrier assembly.

**NOTE**

Use care not to strike the companion flange.



## INSTALLATION

1. Apply specified sealant to axle housing flange surface, and install the differential carrier assembly.

---

Specified sealant : Three bond 1215 or equivalent

---

Tightening torque :

23-27Nm (2.3-2.7kg·m, 16-19lb·ft)

---

Align the match marks on the flange yoke and companion flange, and install the propeller shaft.

---

Tightening torque :

50-60Nm (500-600kg·cm, 37-44lb·ft)

---

- (1) Apply specified sealant to the axle housing and bearing case end faces.

---

Specified sealant : Three bond 1104

---

## DISASSEMBLY

### 1. SIDE BEARING NUT

#### NOTE

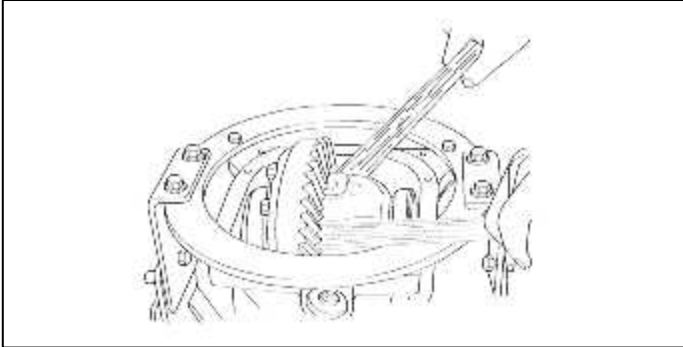
Keep the right and left side bearing nuts separate so that they are not mixed during reassembly.



## 2. REMOVAL OF THE DIFFERENTIAL CASE ASSEMBLY

### CAUTION

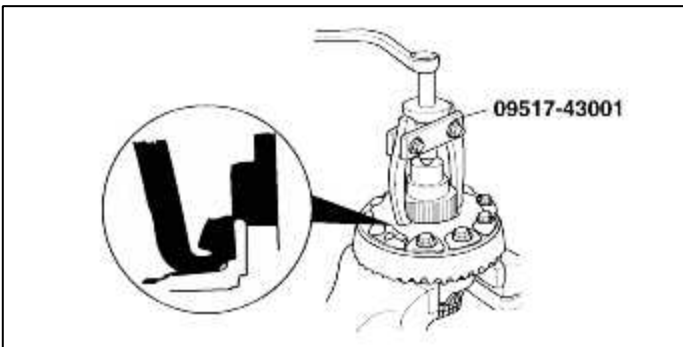
- Remove the differential case assembly slowly and carefully.
- Be careful so that the side bearing outer race is not dropped.
- Keep the right and left side bearing outer races separate so that they are not mixed during reassembly.



3. REMOVAL OF THE SIDE BEARING INNER RACES Fit the nut on top of the differential case, and then uses the special tool to remove the side bearing inner race.

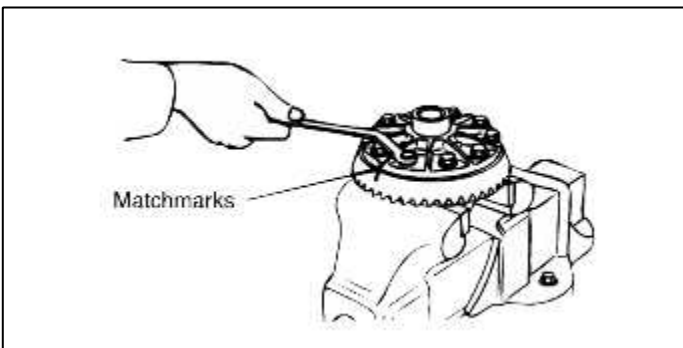
### NOTE

Attach the prongs of the special tool (09517-43001) to the inner race of the side bearing through the notched section in the differential case.



## 4. REMOVAL OF DRIVE GEAR

- Make the match marks to the differential case and the drive gear.
- Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.





## 5. REMOVAL THE LOCK NUT



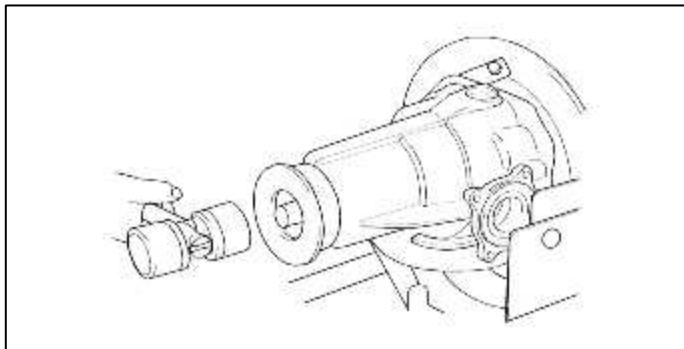
## 6. REMOVAL OF DRIVE PINION

A. Make the matchmarks on the drive pinion and companion flange.

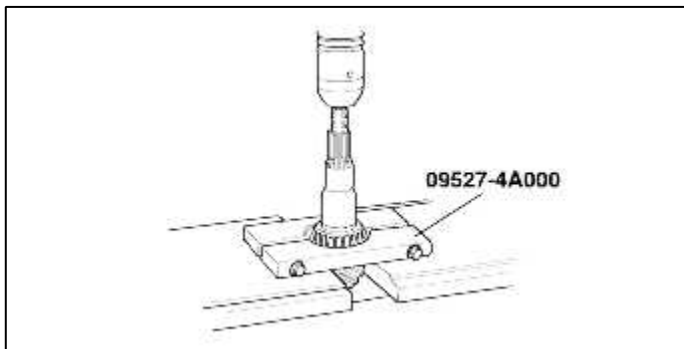
### CAUTION

Match marks should not be made on the contact surfaces of the companion flange and the propeller shaft.

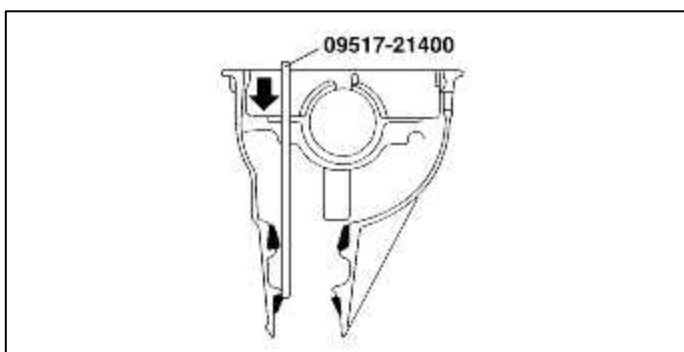
B. Drive out the drive pinion together with the drive pinion spacer and drive pinion front shims.



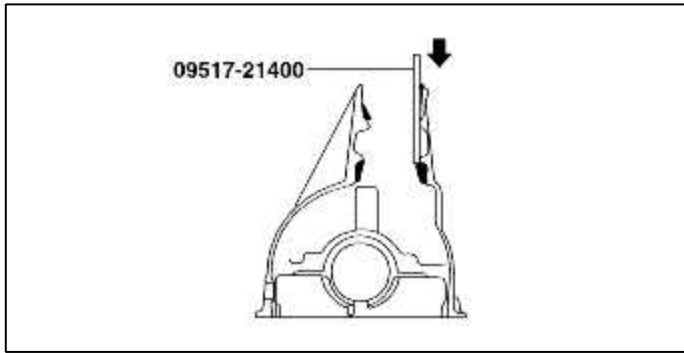
## 7. REMOVAL OF DRIVE PINION REAR BEARING INNER RACE



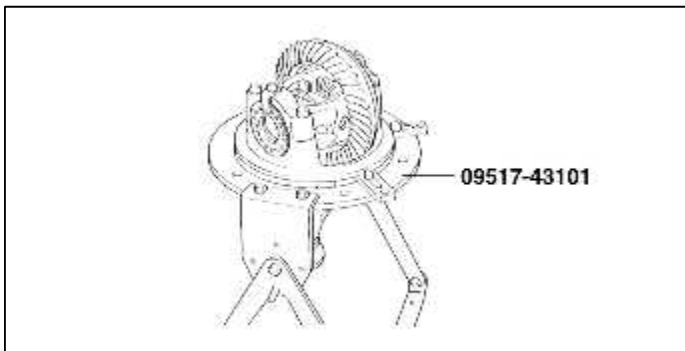
## 8. REMOVAL OF OIL SEAL/DRIVE PINION FRONT BEARING INNER RACE/DRIVE PINION FRONT BEARING OUTER RACE



## 9. REMOVAL OF DRIVE PINION REAR BEARING OUTER RACE



## INSPECTION BEFORE DISASSEMBLY



## 1. FINAL DRIVE GEAR BACKLASH

Check the final drive gear backlash by the following procedure.

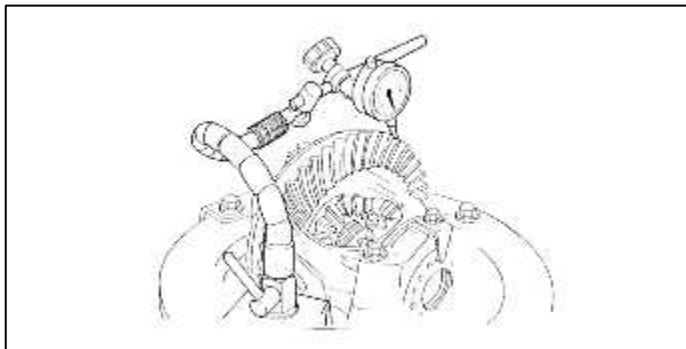
- (1) Place the drive pinion and move the drive gear to check backlash is within the standard range.

### NOTE

Measure at 4 points on the gear periphery.

Standard value

0.13-0.18 mm (0.0051-0.0071 in.)



- (2) Adjust with the side bearing nuts if backlash values are not within standard range.

### NOTE

After adjusting, check the state of the final drive gear's tooth contact.

## 2. DRIVE GEAR RUNOUT

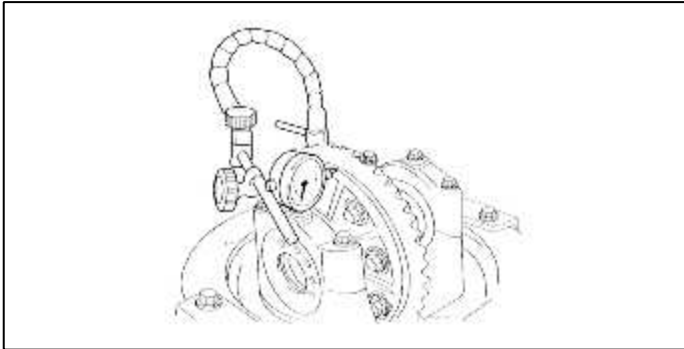
Check the back-face lash as follows:

- (1) Place a dial gauge on the back-face of the drive gear and measure the runout.

---

Limit : 0.05mm (0.0020in.)

---



- (2) If the run out is beyond the limit, check that there are no foreign substances between the drive gear and differential case and, that the bolts fixing the drive gear are not loose.

## 3. DIFFERENTIAL GEAR BACKLASH

- (1) Fix the side gear with a wedge so it cannot move and measure the differential gear backlash with a dial indicator on the pinion gear.

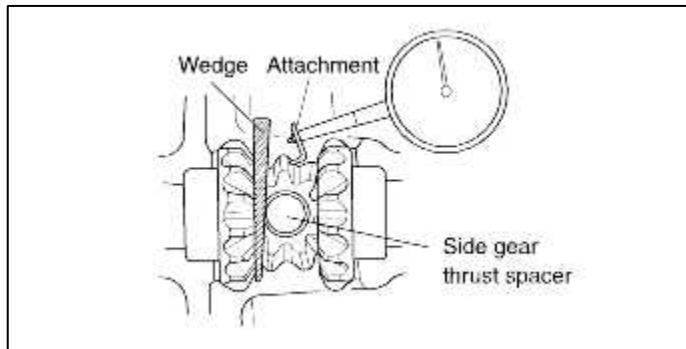
**NOTE**

Take the measurements at two places on the pinion gear.

---

Standard value : 0-0.1 mm (0-0.0039 in.)

---



- (2) If the backlash exceeds the limit, adjust using side bearing spacers.

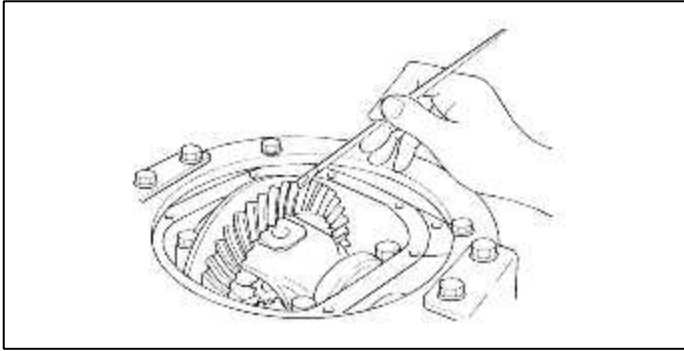
**NOTE**

If adjustment is impossible, replace the side gear and pinion gears as a set.

#### 4. FINAL DRIVE GEAR TOOTH CONTACT

Check the final drive gear tooth contact by following the steps below :

- (1) Apply the same amount of machine blue slightly to both surfaces of the drive gear teeth.

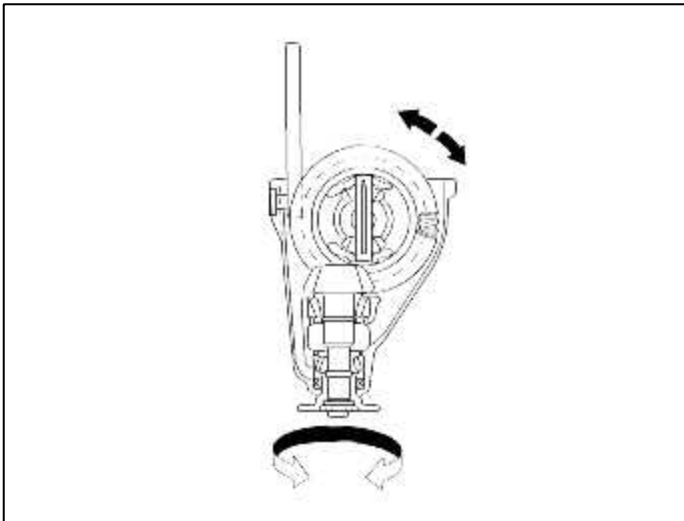


- (2) Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that some torque (approximately 25-30kg·cm) is applied to the drive pinion.

##### CAUTION

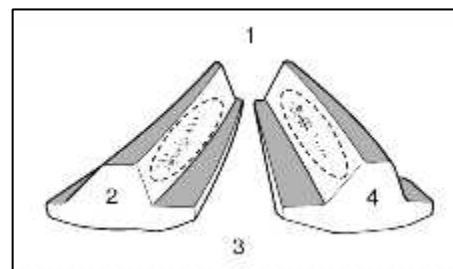
If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

- (3) Check the tooth contact pattern.

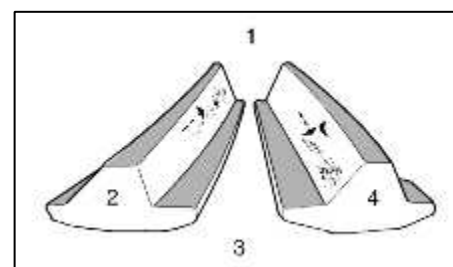
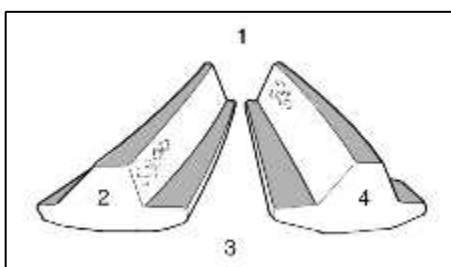


**Standard tooth contact pattern**

1. Narrow tooth side
2. Drive-side tooth surface (the side receiving power during acceleration)
3. Wide tooth side
4. Coast-side tooth surface (the side receiving power during coast-down)

**Problem****Solution**

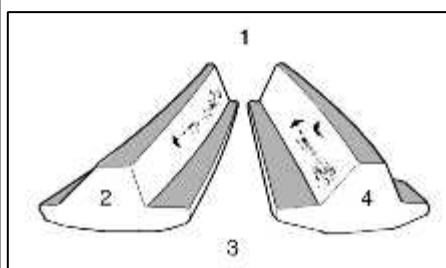
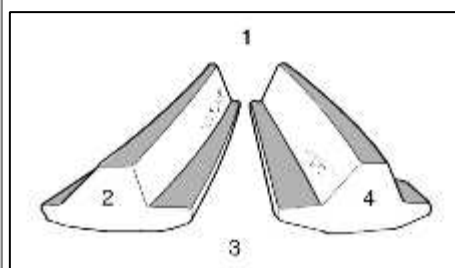
Tooth contact pattern resulting from excessive pinion height



The drive pinion is positioned too far from the center of the drive gear.

Also, for backlash adjustment, reposition the drive gear further from the drive pinion.

Tooth contact pattern resulting from insufficient pinion height



The drive pinion is positioned too close to the center of the drive gear.

Decrease the thickness of the pinion height adjusting shim, and position the drive pinion further from the center of the drive gear.  
Also, for backlash adjustment, reposition the drive gear closer to the drive pinion.

**NOTE**

- Tooth contact pattern is a method for judging the result of the adjustment of drive pinion height and final drive gear backlash. The adjustment of drive pinion height and final drive gear backlash should be repeated until the tooth contact patterns are similar to the standard tooth contact pattern.
- When you cannot obtain a correct pattern, the drive gear and drive pinion have exceeded their limits. Both gears should be replaced as a set.

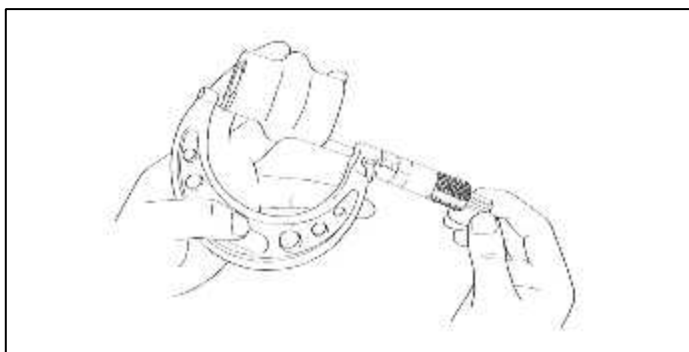
**INSPECTION**

1. Check the companion flange for wear or damage.
2. Check the bearings for wear or discoloration.
3. Check the gear carrier for cracks.
4. Check the drive pinion and drive gear for wear or cracks.
5. Check the side gears, pinion gears and pinion shaft for wear or damage.

6. Check the side gear spline for wear or damage.
7. Check the length of the distance piece.

Standard length :

54.80-58.09 mm(2.16-2.21 in.)

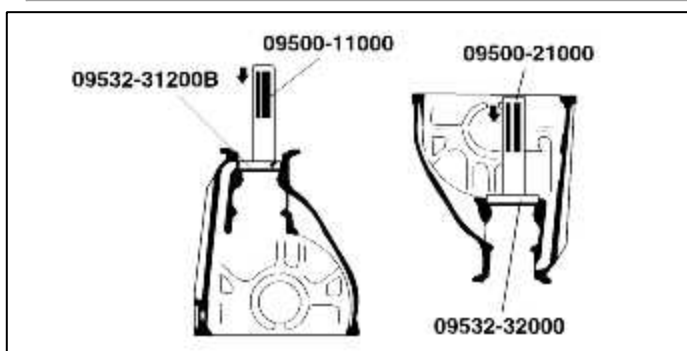


## REASSEMBLY

1. Install the drive pinion rear bearing outer race and drive pinion front bearing outer race using the special tools (09500-11000, 09500-21000, 09532-31200B and 09532-32000).

### CAUTION

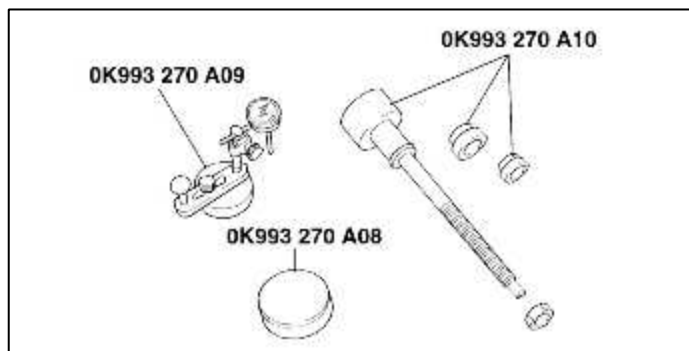
Be careful not to press in the outer race when it is inclined.



## 2. ADJUSTMENT OF PINION HEIGHT

Adjustment the drive pinion height by the following procedure.

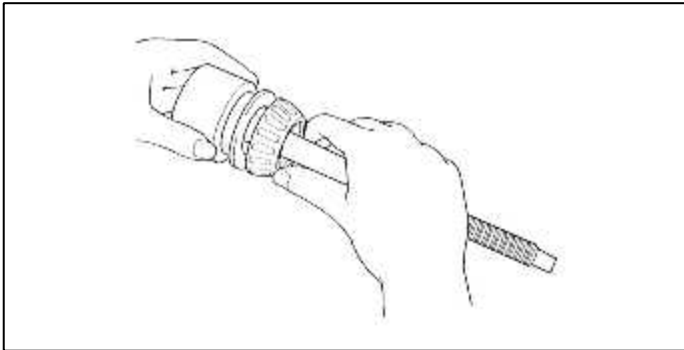
- (1) For assembly of pinion, use drive pinion model (0K993 270 A01), pinion height adjustment gauge body (0K993 270 A09) and gauge block (ht. 28 mm (1.102in)).



(2) Assemble spacer and inner bearing inner race to pinion model and fix it with O-ring.

**NOTE**

- Use spacer disassembled.



(3) Install pinion model assembly to carrier.

(4) Assemble outer bearing, companion flange washer, and lock nut.

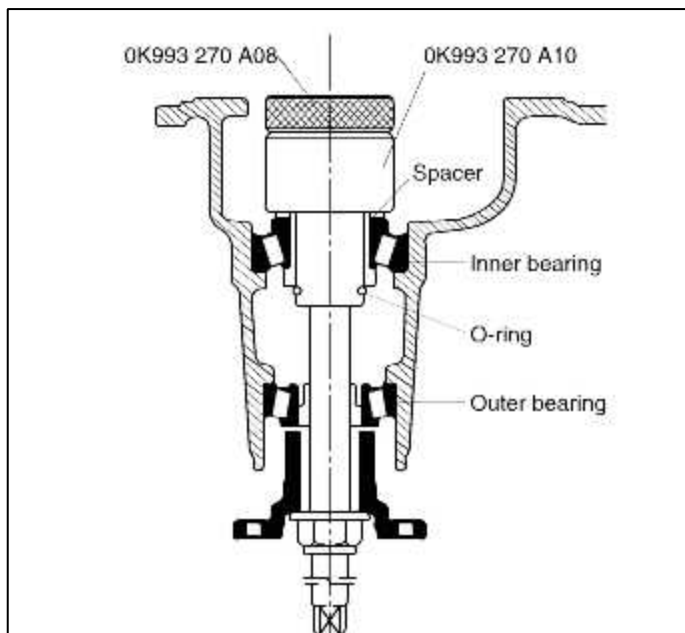
**NOTE**

- Use washer and lock nut disassembled.

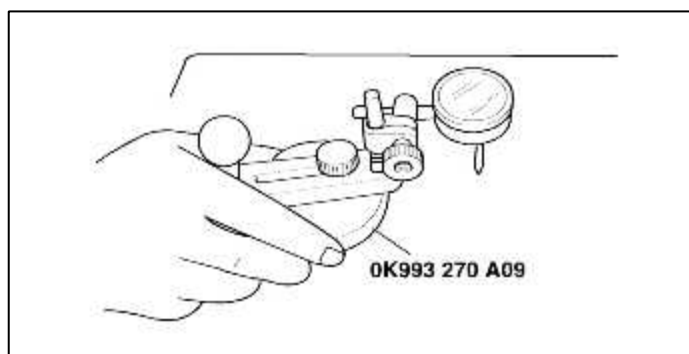
(5) Tighten lock nut.

**NOTE**

- Tighten to the extent the companion flange can be screwed by hand.



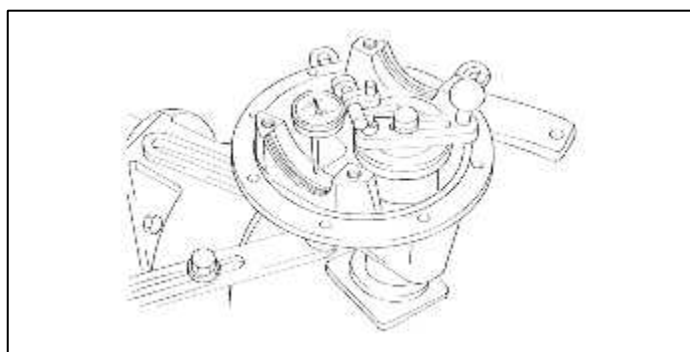
- (6) Put pinion height adjusting gauge body at right angle and adjust it to 0.



- (7) Put pinion height adjusting gauge body and gauge block to the upper side of pinion model.

- (8) Dial gauge needle should be placed at the lowest part of side bearing.

- (9) Measure minimum positions of both sides (LH, RH).



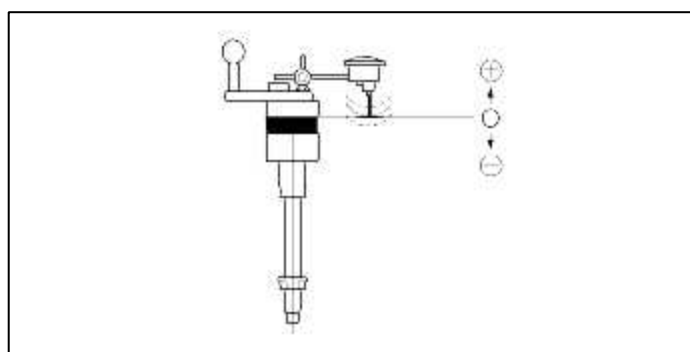
- (10) Add both values and divide it by 2.

- (11) If the value of the above step 10 is not within specification, use new spacer adding the values to current spacer.

Standard clearance :

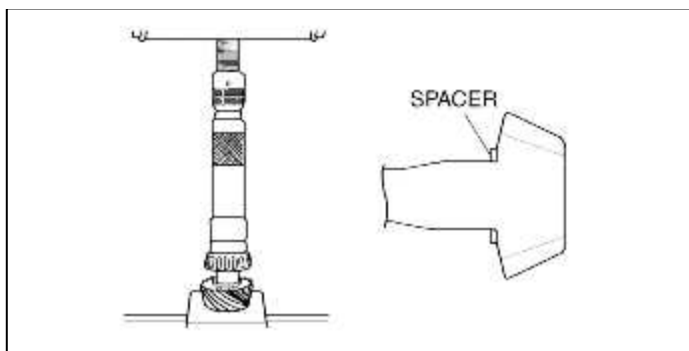
-0.025~0.025 mm (-0.001~0.001 in)

MARK	THICKNESS	MARK	THICKNESS
08	3.08(0.1212)	29	3.29(0.1259)
11	3.11(0.1224)	32	3.32(0.1307)
14	3.14(0.1236)	35	3.35(0.1318)
17	3.17(0.1248)	38	3.38(0.1330)
20	3.20(0.1259)	41	3.41(0.1342)
23	3.23(0.1271)	44	3.44(0.1354)
26	3.26(0.1283)	47	3.47(0.1366)



### 3. Adjustment of drive pinion preload.





- (1) Install spacer.
- (2) Push inner bearing in using SST.

#### NOTE

- Keep pressuring until the sudden increase of necessary power.
- Place the spacer for adjusting pinion height, ensuring exact direction of installation.

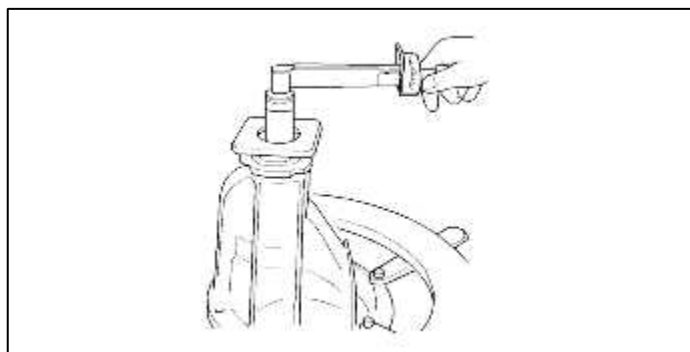
- (3) Install distance piece.
- (4) Push outer bearing in using SST.
- (5) Install drive pinion assembly.
- (6) Install companion flange and tighten lock nut.

Tightening torque :

127-284 N·m (13-29 kg·m, 94-210 lb·ft)

#### NOTE

- Do not install oil seal.



- (7) Turn companion flange by hand so that bearing be put at the right place.
- (8) Measure preload of drive pinion. If the result is not within specification, use new distance piece and measure again.

Preload :

127-176 N·m (13-18 kg·cm, 94-130 lb·ft)

- (9) Remove the lock nut and then install the oil seal.

(10) Install the companion flange and tighten lock nut.

Tightening torque :

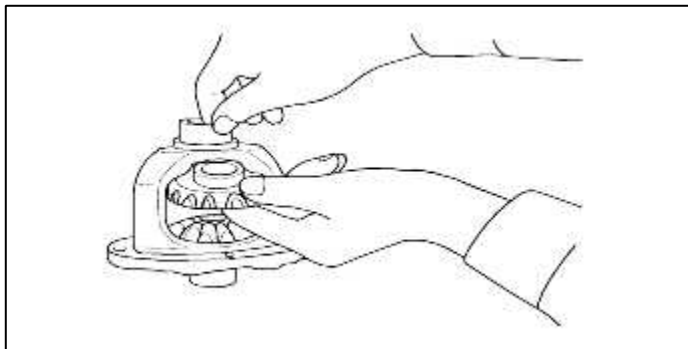
127-284 N·m (13-29 kg·m, 94-210 lb·ft)

#### ADJUSTMENT OF DIFFERENTIAL GEAR BACKLASH

1. Assemble the side gears, side gear spacers, pinion gears, and pinion washers into the differential case.
2. Temporarily, install the pinion shaft.

##### NOTE

Do not install the lock pin yet.



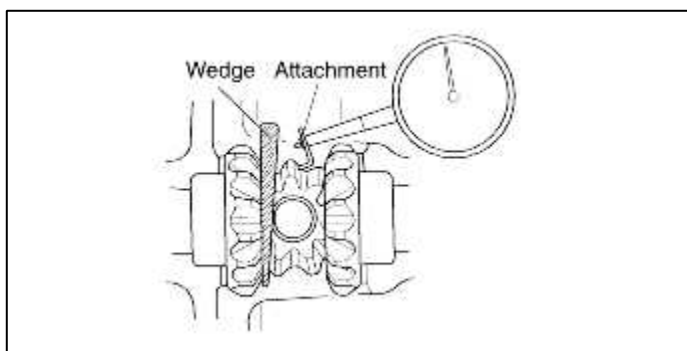
3. Insert a wedge in the side gear and measure the differential gear backlash with a dial indicator on the pinion gear.

##### NOTE

Measure both pinion gears separately.

Standard value : 0-0.1 mm (0-0.0039 in.)

Limit : 0.2 mm (0.008 in.)



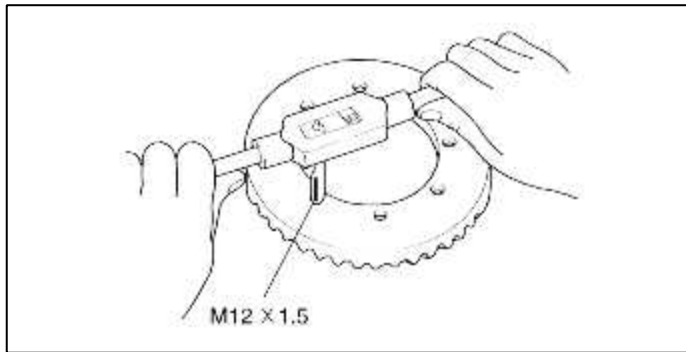
4. If the differential gear backlash exceeds the limit, adjust the backlash by installing thicker side gear thrust spacers.
5. Measure the differential gear backlash once again, and confirm that it is within the limit.

##### NOTE

- After adjustment, check that the backlash is within the limit and the differential gear rotates smoothly.
- When adjustment is impossible, replace the side gear and the pinion gear as a set.

## 6. Installation of the drive gear

- A. Clean the drive gear attaching bolts.
- B. Remove the adhesive on the threaded holes of the drive gear with tap (M12 x 1.5), and then clean the threaded holes with compressed air.

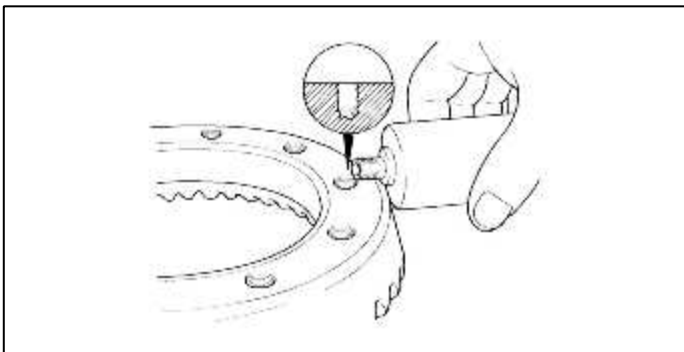


- C. Apply the specified adhesive to the threaded holes of the drive gear.

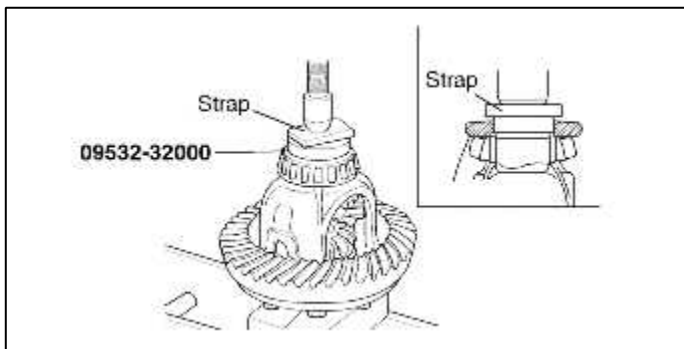
Specified adhesive :

LOCTITE #262 or equivalent

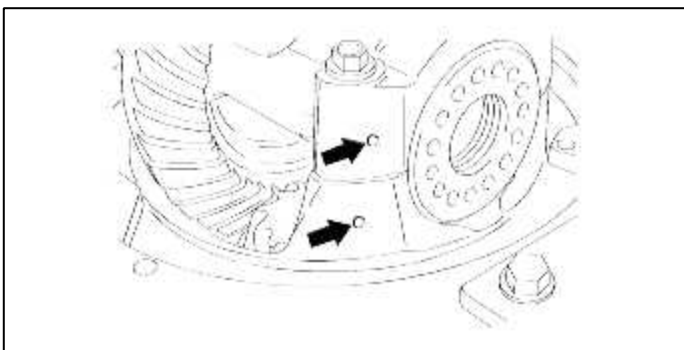
- D. Install the drive gear in the differential case with the matchmarks properly aligned. Tighten the bolts to the specified torque (11-15 kg·m) in a diagonal sequence.



## 7. Press-fit the side bearing inner race



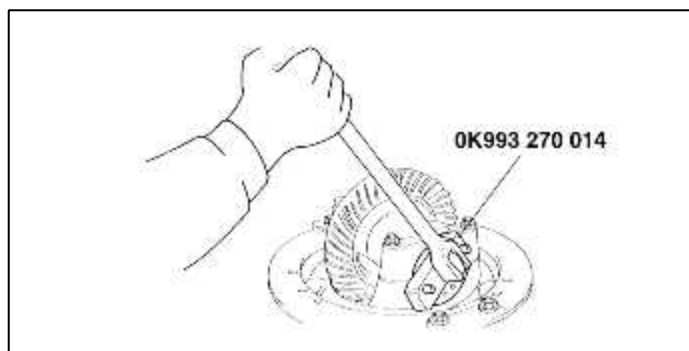
8. Align the match mark on the gear carrier and the bearing cap, and then tighten the bearing cap.



## 9. ADJUSTMENT OF FINAL DRIVE GEAR BACKLASH

Adjust final drive gear backlash as follows :

- (1) Using the special tool (09521-43001), temporarily tighten the side bearing nut until it is in the state just before preloading of the side bearing.



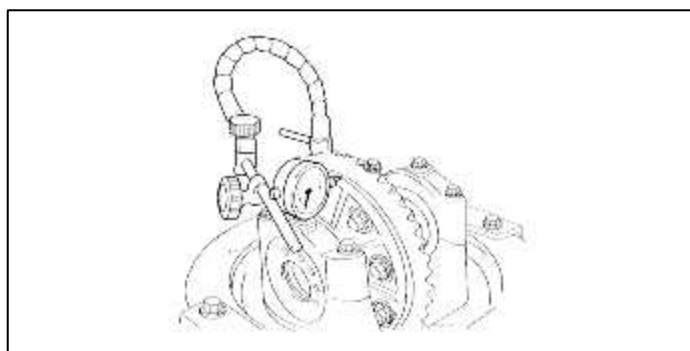
- (2) Measure the final drive gear backlash.

Standard value :

0.13-0.18mm (0.0051-0.0071 in.)

#### NOTE

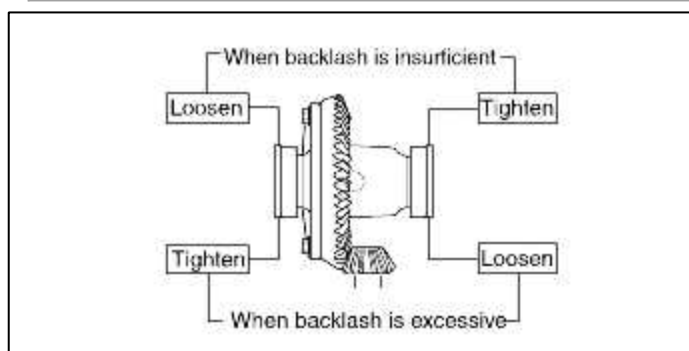
Measure at least 4 points on the drive gear periphery.



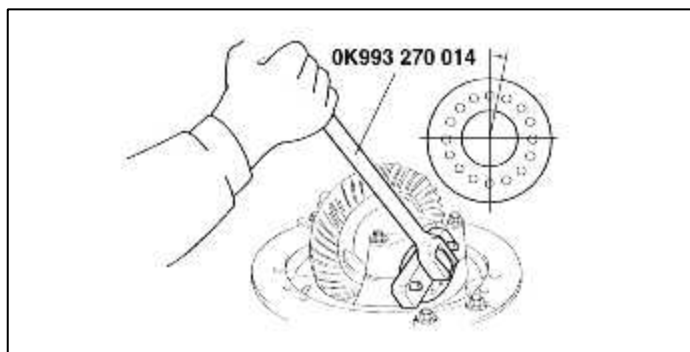
- (3) Using the special tool (09521-43000), adjust the backlash to standard value by moving the side bearing nut as shown.

#### NOTE

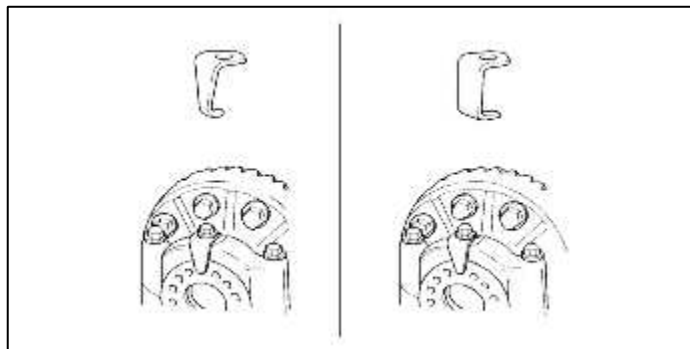
First turn the side bearing nut for loosening, and then turn (by the same amount) the side bearing nut for tightening.



- (4) Using the special tool (09521-43001) to apply the preload, turn down both right and left side bearing nut on half the distance between centers of two neighboring holes.



- (5) Choose and install the lock plates two kinds.



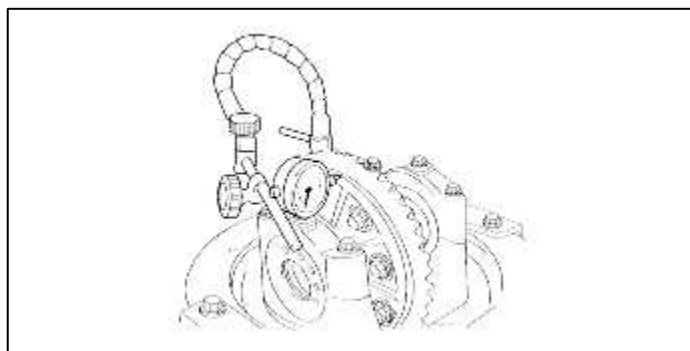
- (6) Check the final drive gear tooth contact. If poor contact is evident, make adjustment.  
 (7) Measure the drive gear run out.

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Limit : 0.05mm (0.0020in.)

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- (8) When drive gear run out exceeds the limit, remove the differential case and then the drive gears, moving them to different positions and reinstalling them.

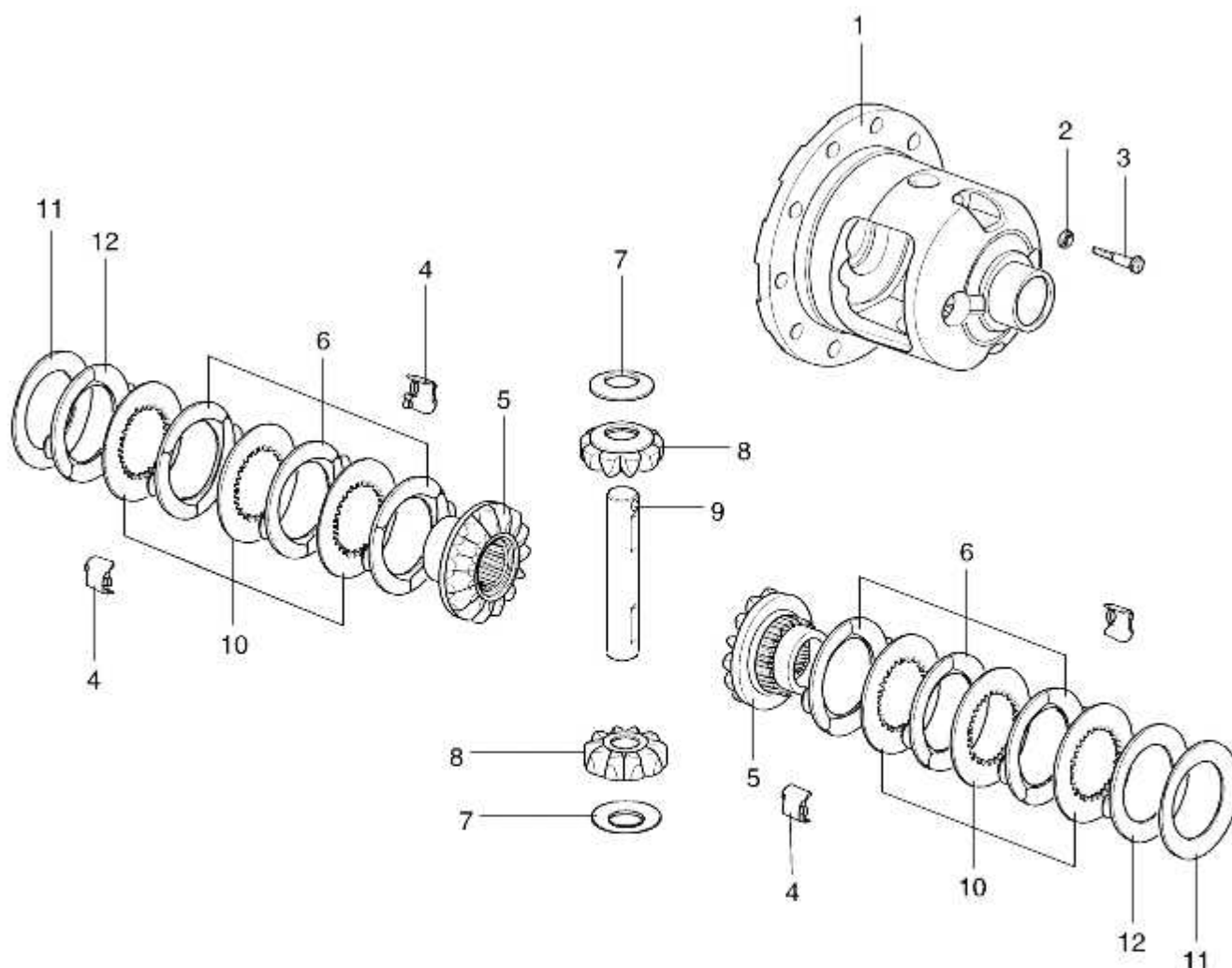


## Driveshaft and axle > Differential Carrier Assembly > Limited Slip Differential (LSD) > Description and Operation

### DESCRIPTION

## Driveshaft and axle > Differential Carrier Assembly > Limited Slip Differential (LSD) > Components and Components Location

### COMPONENTS



- |  |   |
|--|---|
| 1. Case                                  | 7. Thrust washer-pinion                 |
| 2. Washer-lock                           | 8. Pinion gear                          |
| 3. Screw-lock                            | 9. Cross shaft-pinion                   |
| 4. Guide-ear                             | 10. Disc-splined friction               |
| 5. Gear-side                             | 11. Shim-side gear                      |
| 6. Eared disc S/A (carbon on both sides) | 12. Eared disc S/A (carbon on one side) |

### Driveshaft and axle > Differential Carrier Assembly > Limited Slip Differential (LSD) > Repair procedures

#### DISASSEMBLY

1. Remove the threaded lock screw and the cross shaft.
2. Without preload on the side gears they can be turned by hand. Rotate the side gears until the pinions are in the window area. Remove the pinions and pinion thrust washers.
3. Remove the gear sub-assemblies (side gear, disc pack, ear guides and disc pack shims). Do not mix parts. Identify the parts so they can be reassembled to the original location.

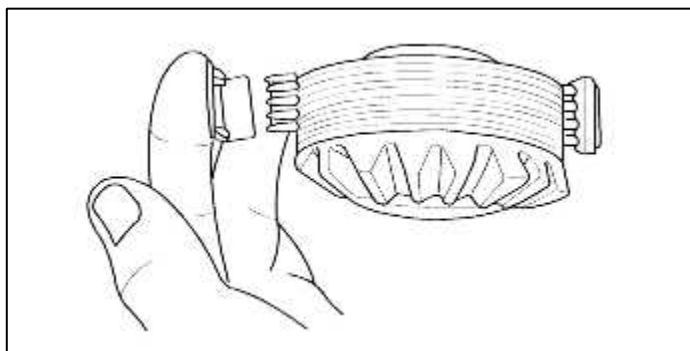
#### INSPECTION

1. Check the side gears, pinions, pinion thrust washers, and cross shaft for wear or damage. If there is excessive wear, cracks, nicks, grooves or galling replace the parts.

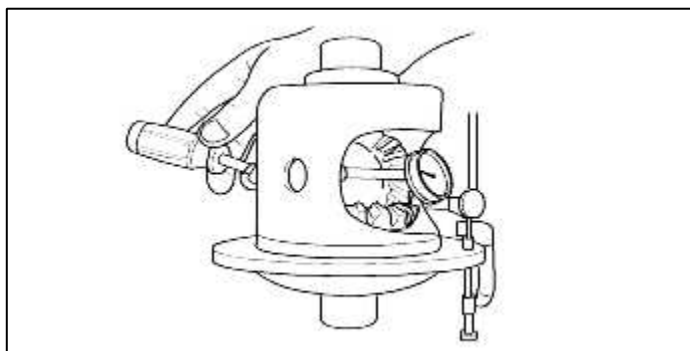
2. Inspect the carbon surfaces. After cleaning with a solvent, the carbon surface should appear like a coarse weave fabric with flat spots on the peaks of the weave. If the surface is smooth, either from wear or from the weave filled with debris, replace the entire disc pack.
3. Measure the thickness of the carbon friction discs. If any of the double sided discs are less than 2.56 mm (0.101 in.) or the single sided disc is less than 2.15 mm (0.085 in.), replace the entire disc pack.
4. Inspect the splined friction discs. If they have grooves or a mirror like finish, replacing the entire disc pack. Small scratches on a buff like finish are okay.

## REASSEMBLY AND SHIM SELECTION

1. Apply axle lubricant to all sliding surfaces. Be especially careful to coat the mating surfaces of the friction discs.
2. Starting with a double sided eared disc next to the side gear, stack four eared discs and three splined discs on to the spline of side gear. A splined disc goes in between each eared disc with the last eared disc being single sided and the carbon surface facing the side gear. Use a heavy bearing grease in the ear guides to hold them in place during assembly.



3. Select a shim 0.76mm (0.030 in.) thick and place on the hub side of the disc pack subassembly.
4. Lubricate and assemble the other side gears as above.
5. Install the flange end side gear subassembly and shim in the flange end of the differential case.
6. Position pinion gears and thrust washers on the side gears and install the cross shaft through the case and pinions.
7. Install a dial indicator on the case so that the indicator tip rests against a pinion tooth face.
8. Compress the clutch pack with a large screwdriver or pry bar as shown. Rotate the pinion gear back and forth to obtain backlash. Tooth backlash should be 0 to 0.10mm (0 to 0.004 in.). If required, change the 0.76mm (0.30 in.) Shim to obtain the proper backlash.

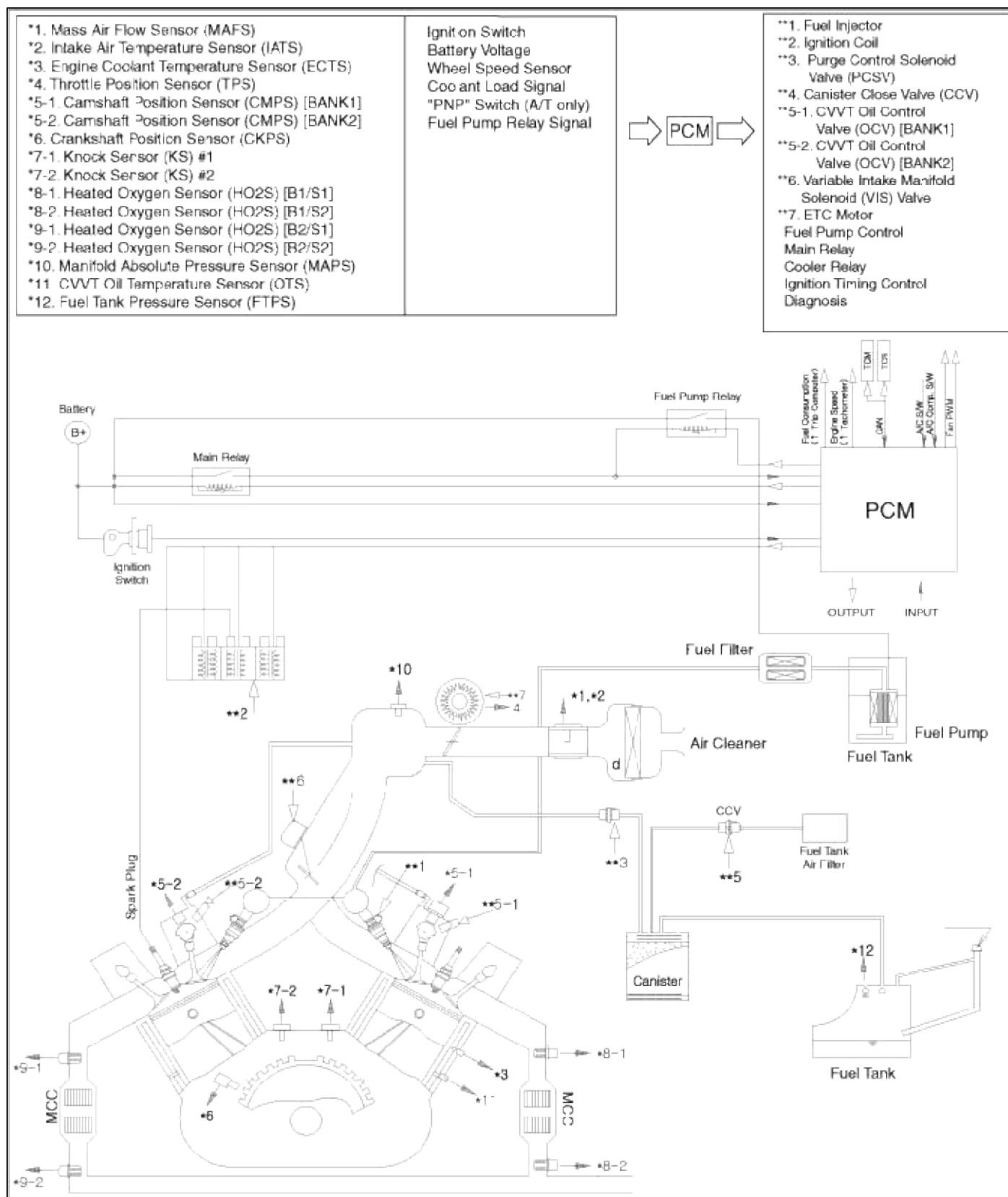


9. Remove the side gear subassembly and repeat the tooth backlash procedure for the other gear pack on the opposite side of the case.
10. Remove the cross shaft, pinions and thrust washers and reinstall the first side gear subassembly and shim in the flange end of the case.
11. Install a pinion and thrust washer through each window so that the gear teeth mesh and so that the pinions are in line with each other. Rotate one side gear so the pinions and thrust washers rotate at a position where they line up with the cross shaft holes in the case.
12. Install the pinion shaft, lock screw and lock washer. Tighten the lock screw to 30-40Nm (3.1~4.1 kg·m, 22-29 lb·ft ) torque.

# SORENTO(BL) > 2007 > G 3.3 DOHC > Emission Control System

## Emission Control System > General Information > Schematic Diagrams

### SCHEMATIC DIAGRAM



## Emission Control System > General Information > Description and Operation

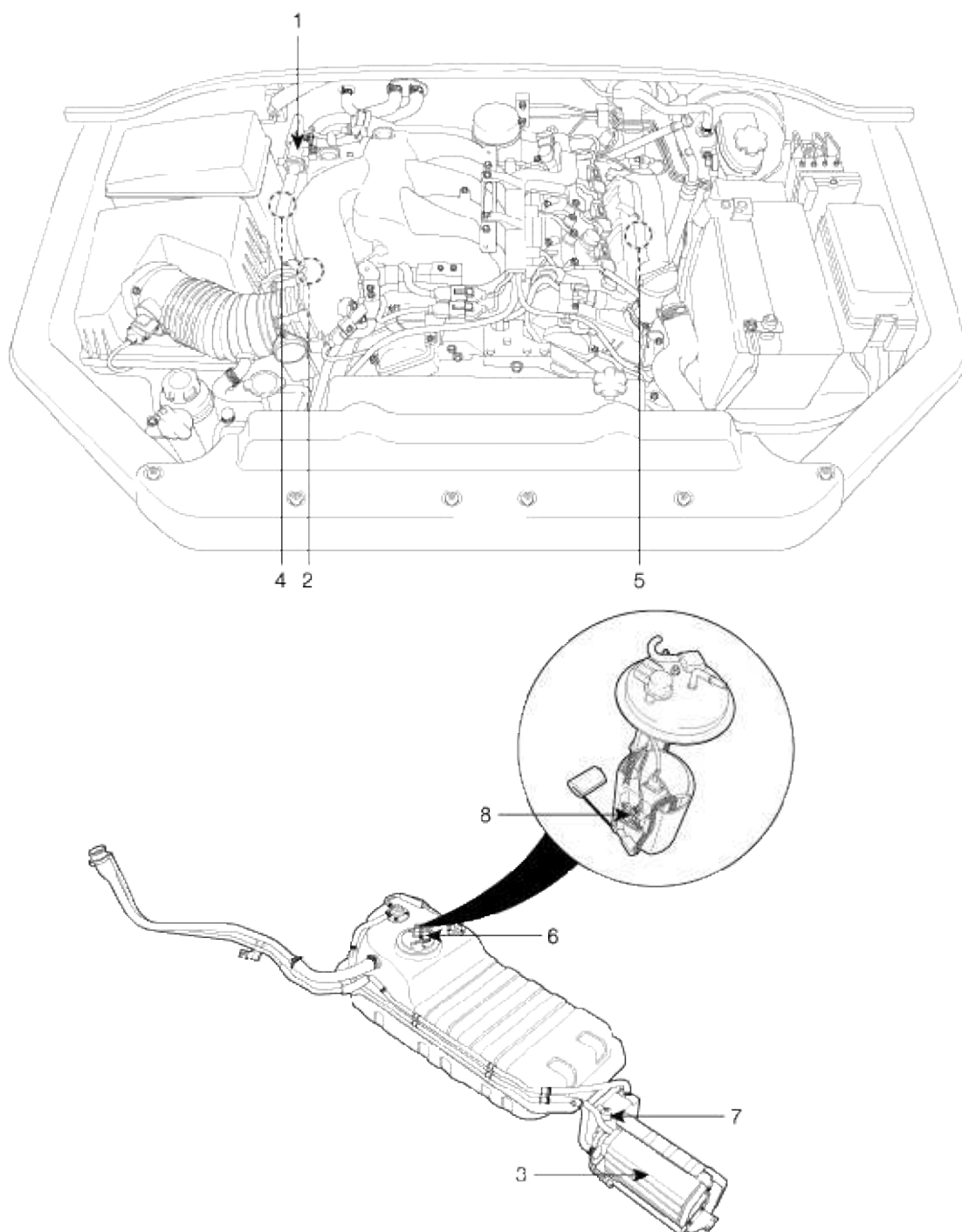


## DESCRIPTION

Components	Function	Remarks
Crankcase Emission System - Positive Crankcase Ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System - Evaporative emission canister - Purge Control Solenoid Valve (PCSV)	HC reduction HC reduction	Duty control solenoid valve
Exhaust Emission System - MFI system (air-fuel mixture control device) - Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor feedback type Monolithic type

**Emission Control System > General Information > Components and Components Location**

## COMPONENT LOCATION



1. Purge Control Solenoid Valve (PCSV)

2. PCV Valve

3. Canister

4. Catalytic Converter (Bank 1)

5. Catalytic Converter (Bank 2)

6. Fuel Tank Pressure Sensor (FTPS)

7. Canister Close Valve (CCV)

8. Fuel Level Sensor (FLS)

## Emission Control System > General Information > Troubleshooting

### TROUBLESHOOTING

Symptom	Suspect area	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the Purge Control Solenoid Valve	Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the PCV valve	Replace
	Malfunction of the evaporative emission canister purge system	Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

### Emission Control System > General Information > Specifications

#### SPECIFICATIONS

Type : Piezo - Resistivity type

Specification

Pressure (kPa)	Output Voltage (V)
-3.75	0.5
0	2.5
+3.75	4.5

Specification

Item	Specification
Coil Resistance ( $\Omega$ )	19.0 ~ 22.0 $\Omega$ [20°C (68°F)]

Specification

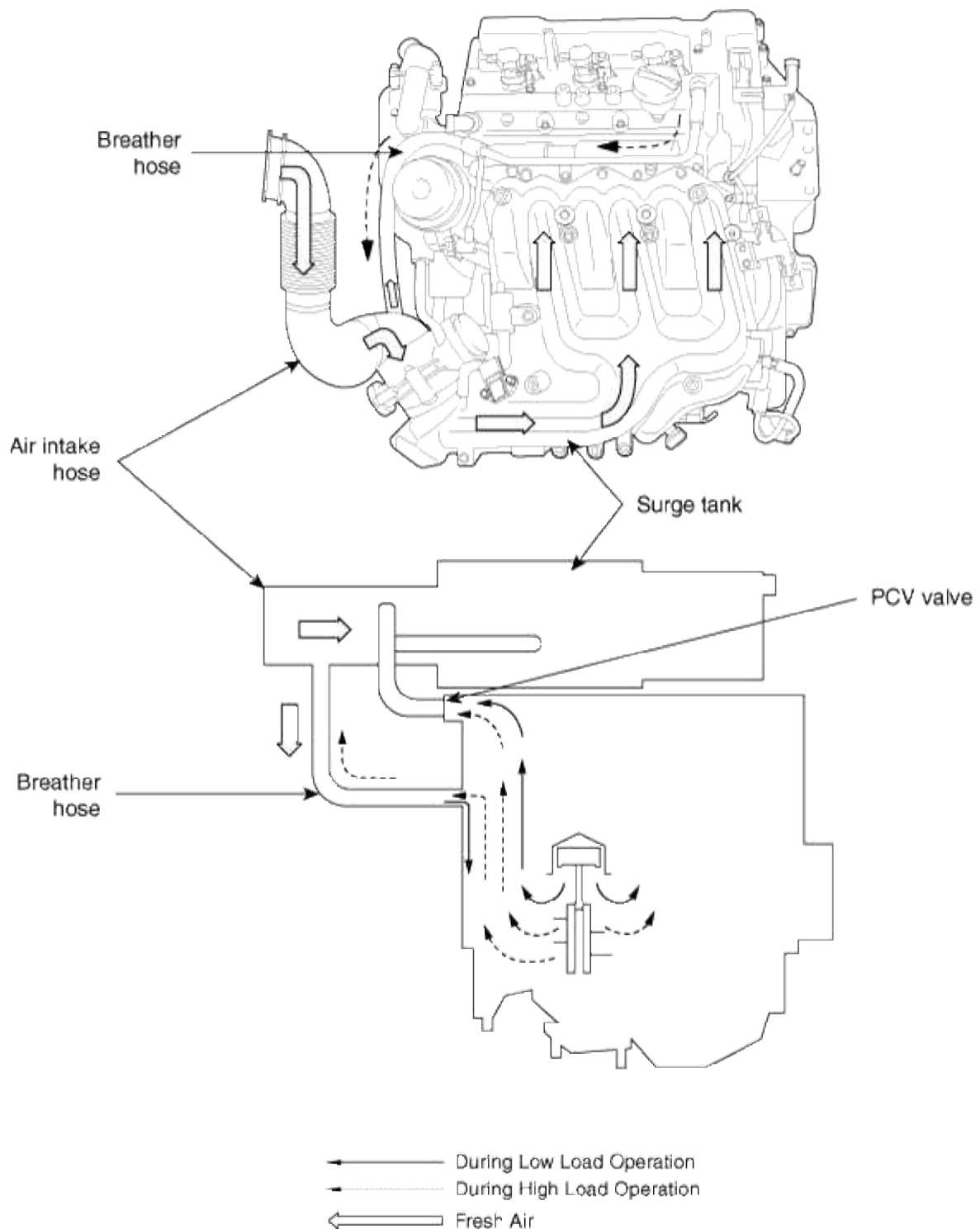
Item	Specification
Coil Resistance ( $\Omega$ )	15.5 ~ 18.5 $\Omega$ [20°C (68°F)]

#### TIGHTENING TORQUE

Item	N·m	kgf·m	lbf·ft
Positive Crankcase Ventilation Valve	8.0 ~ 12.0	0.8 ~ 1.2	6.0 ~ 8.0

### Emission Control System > Crankcase Emission Control System > Components and Components Location

## COMPONENTS


**Emission Control System > Crankcase Emission Control System > Repair procedures**

## INSPECTION

1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.

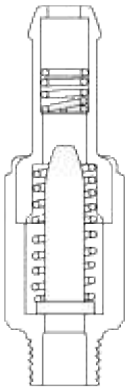
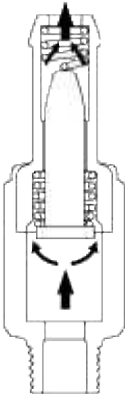
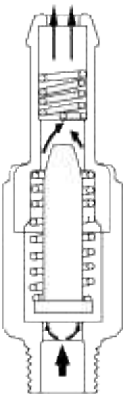
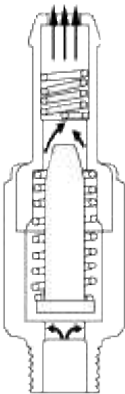
2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum can be felt.

**NOTE**

The plunger inside the PCV valve will move back and forth.

## Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Description and Operation

### OPERATION

<p>Intake manifold side (No vacuum)</p>  <p>Rocker cover side</p>		<p>Intake manifold side (High vacuum)</p>  <p>Rocker cover side</p>	
Engine condition	Not running	Engine condition	Idling or decelerating
PCV valve	Not operating	PCV valve	Fully operating
Vacuum passage	Restricted	Vacuum passage	Small
<p>Intake manifold side (Moderate vacuum)</p>  <p>Rocker cover side</p>		<p>Intake manifold side (Low vacuum)</p>  <p>Rocker cover side</p>	
Engine condition	Normal operation	Engine condition	Accelerating and high load
PCV valve	Properly operating	PCV valve	Slightly operating
Vacuum passage	Large	Vacuum passage	Very large

## Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Repair procedures

### REMOVAL

1. Remove the valve pad and disconnect the vacuum hose.
2. Remove the PCV valve.

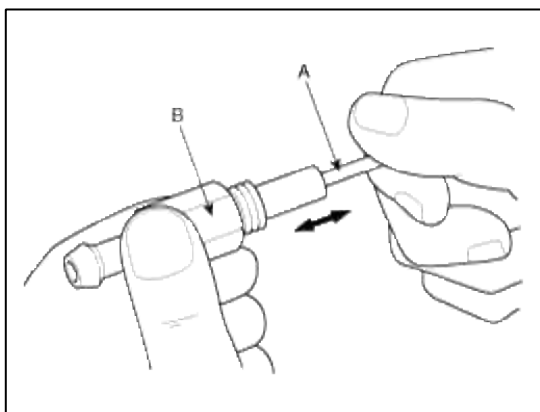
### INSTALLATION

Install the PCV valve and tighten to the specified torque.

PCV Valve installation : 7.8 ~ 11.8 N·m (0.8 ~ 1.2 kgf·m, 5.8 ~ 8.7lb·ft)

### INSPECTION

1. Remove the PCV valve.
2. Insert a thin stick(A) into the PCV valve(B) from the threaded side to check that the plunger moves.
3. If the plunger does not move, the PCV valve is clogged. Clean it or replace.



## Emission Control System > Evaporative Emission Control System > Description and Operation

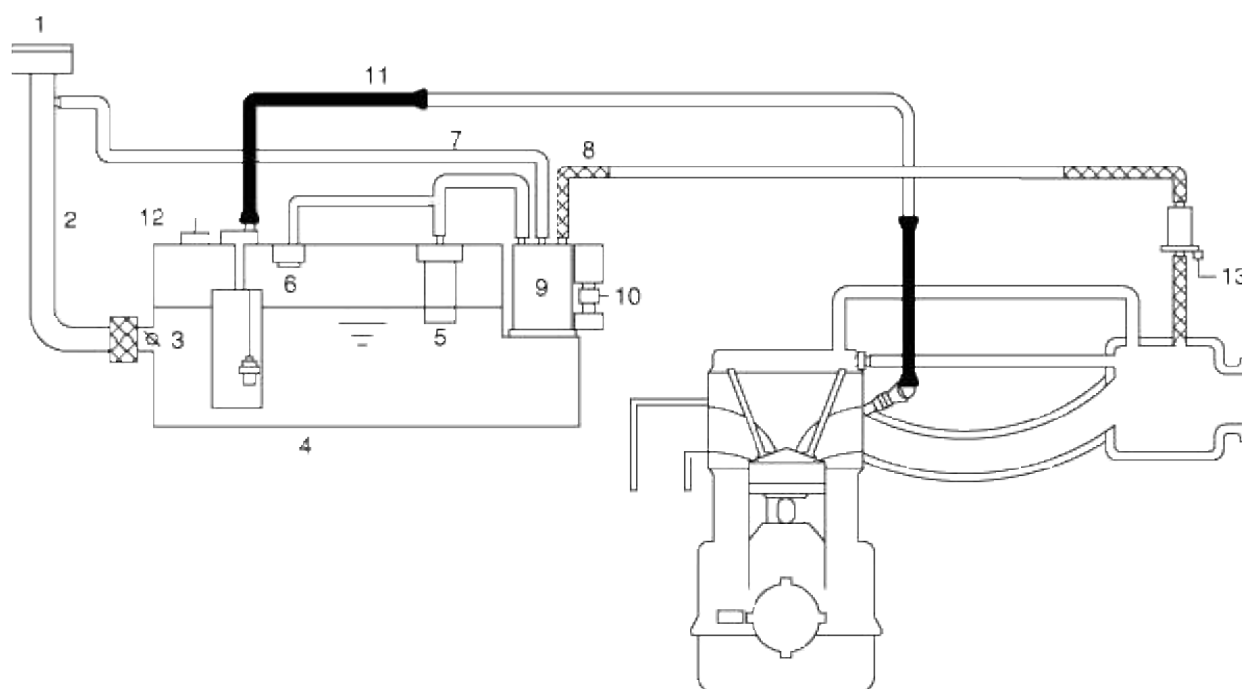
### DESCRIPTION

This system consists of a fill vent valve, fuel shut-off valve, fuel cut valve (for roll over), two way valve (pressure/vacuum relief), fuel liquid/vapor separator which is installed beside the filler pipe, charcoal canister which is mounted under the rear floor LH side member and protector, tubes and miscellaneous connections.

While refueling, ambient air is drawn into the filler pipe so as not to emit fuel vapors in the air. The fuel vapor in the tank is then forced to flow into the canister via the fill vent valve. The fuel liquid/vapor separator isolates liquid fuel and passes the pure vapor to the charcoal canister.

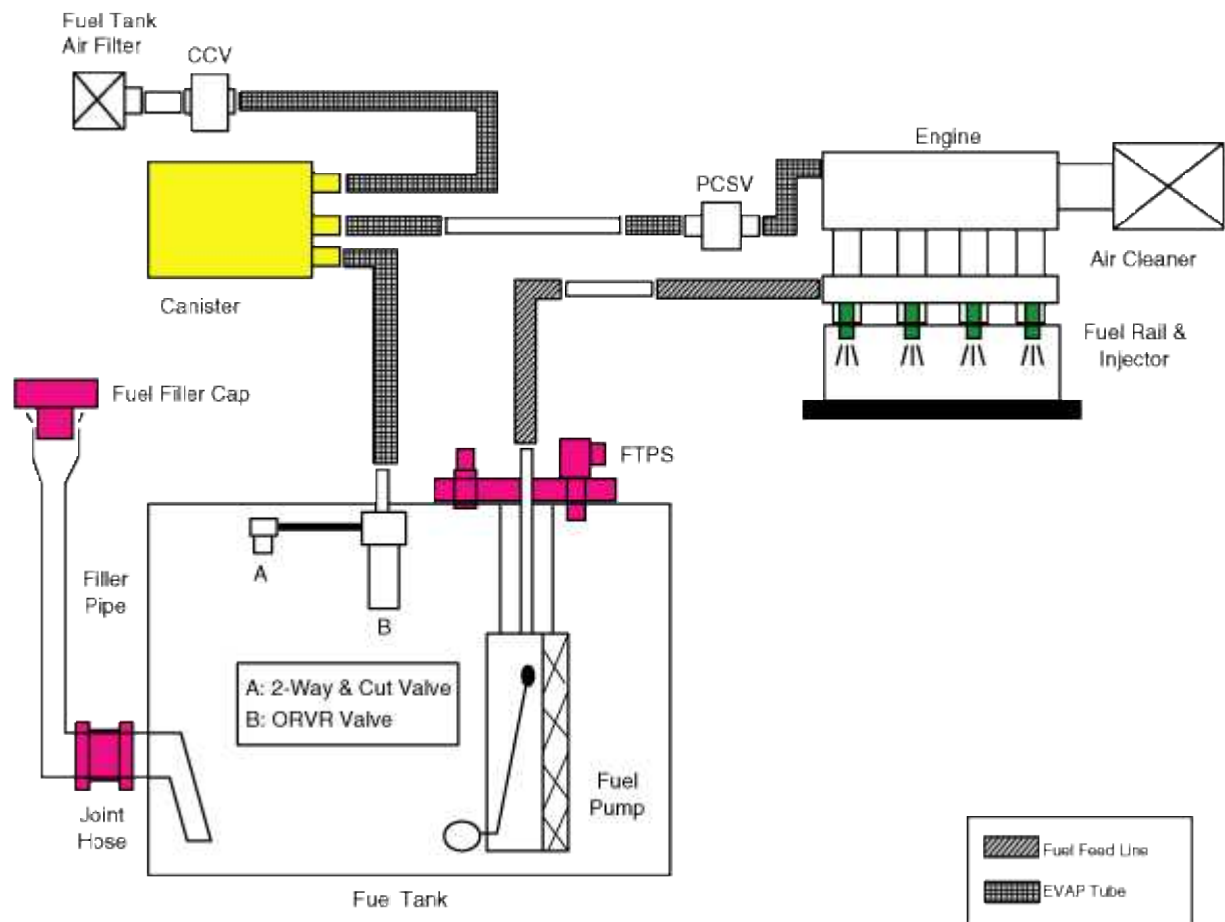
While the engine is operating, the trapped vapor in the canister is drawn into the intake manifold and then into the engine combustion chamber. According to this purge process, the charcoal canister is purged and recovers its absorbing capability.

### COMPONENTS



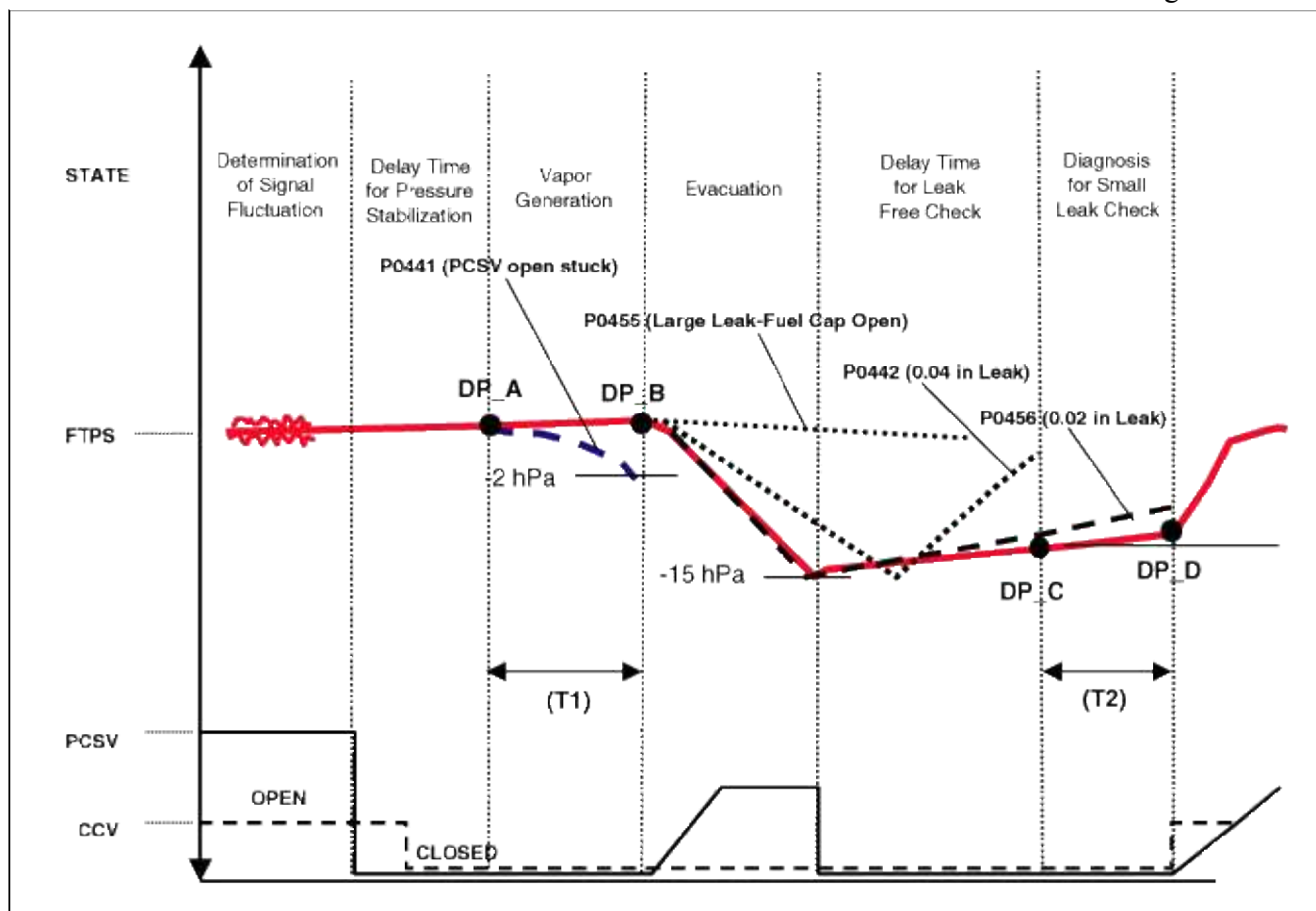
- |                        |   |
|------------------------|---|
| 1. Fuel Filler Cap     | 8. Evaporative Hose                     |
| 2. Fuel Filler Pipe    | 9. Canister                             |
| 3. Fuel Shut-OFF Valve | 10. Canister Close Valve (CCV)          |
| 4. Fuel Tank           | 11. Fuel Feed Line                      |
| 5. ORVR Valve          | 12. Fuel Tank Pressure Sensor (FTPS)    |
| 6. 2-Way & Cut Valve   | 13. Purge Control Solenoid Valve (PCSV) |
| 7. Evaporative Hose    |   |

## DESCRIPTION



## EVAPORATIVE SYSTEM MONITORING





## Emission Control System > Evaporative Emission Control System > Repair procedures

### INSPECTION

1. Disconnect the vacuum hose from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is cold [engine coolant temperature 60°C(140°F) or below] and when it is warm [engine coolant temperature 80°C(176°F) or higher].

### WHEN ENGINE IS COLD

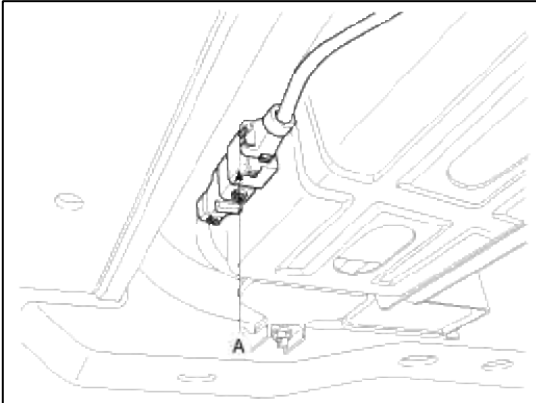
Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
3,000 rpm		

### WHEN ENGINE IS WARM

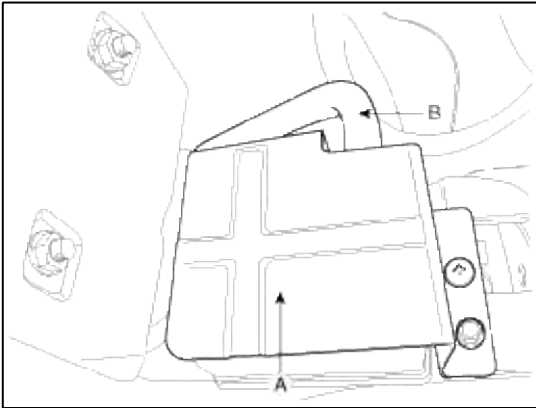
Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
After 3 minutes have passed after engine start at 3,000 rpm	50 kPa (7.3 psi)	Vacuum will be held momentarily, after which, it will be released

**Emission Control System > Evaporative Emission Control System > Canister > Repair procedures****REMOVAL**

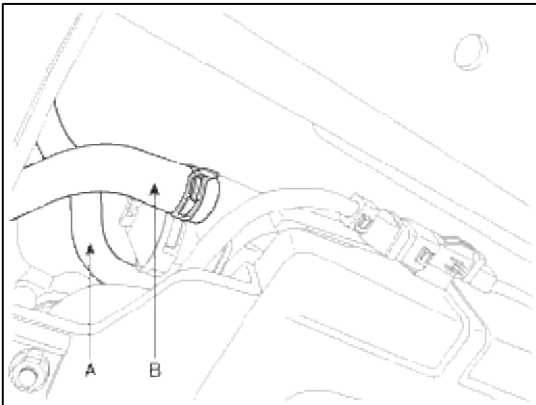
1. Disconnect the canister close valve connector (A).



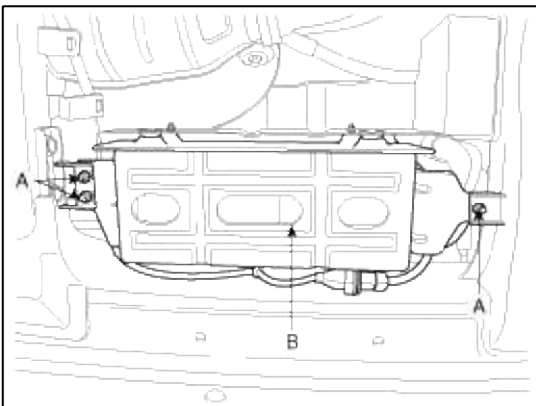
2. Remove the cover (A) and disconnect the vacuum hose (B).



3. Disconnect the vacuum hoses (A,B).



4. Unscrew the mounting nuts (A) and remove the canister assembly (B).

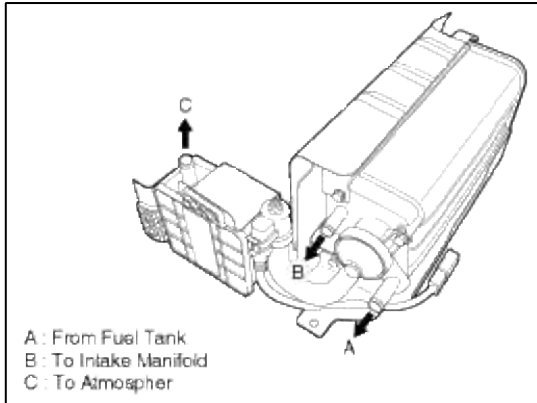


## INSTALLATION

Installation is in reverse order of removal.

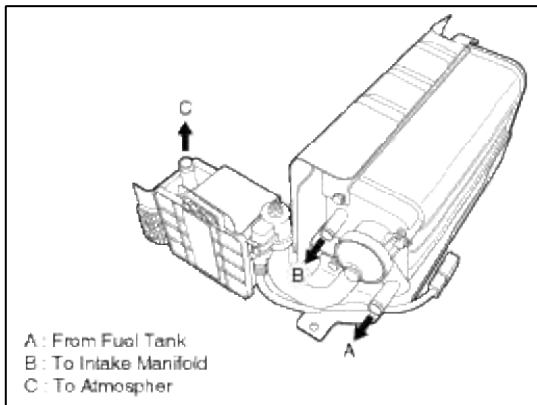
## INSPECTION

1. Look for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel damage.
3. After removing the canister, inspect for cracks, damage or saturated canister.



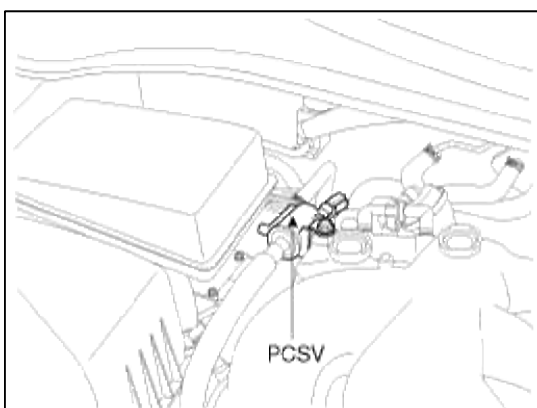
## INSPECTION

1. Look for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel damage.
3. After removing the canister, inspect for cracks, damage or saturated canister.



## Emission Control System > Evaporative Emission Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

## INSPECTION



**NOTE**

When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple which is connected to intake manifold.
4. Apply vacuum and check when voltage is applied to the PCSV and when the voltage is discontinued.

Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained

5. Measure the resistance between the terminals of the solenoid valve.

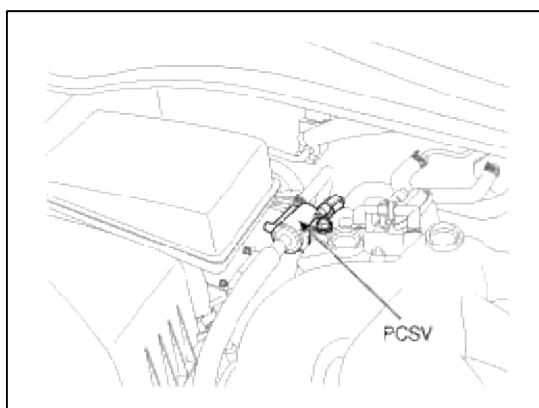
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PCSV coil resistance( $\Omega$ ) : 19.0 ~ 22.0 $\Omega$  at 20°C (68°F)

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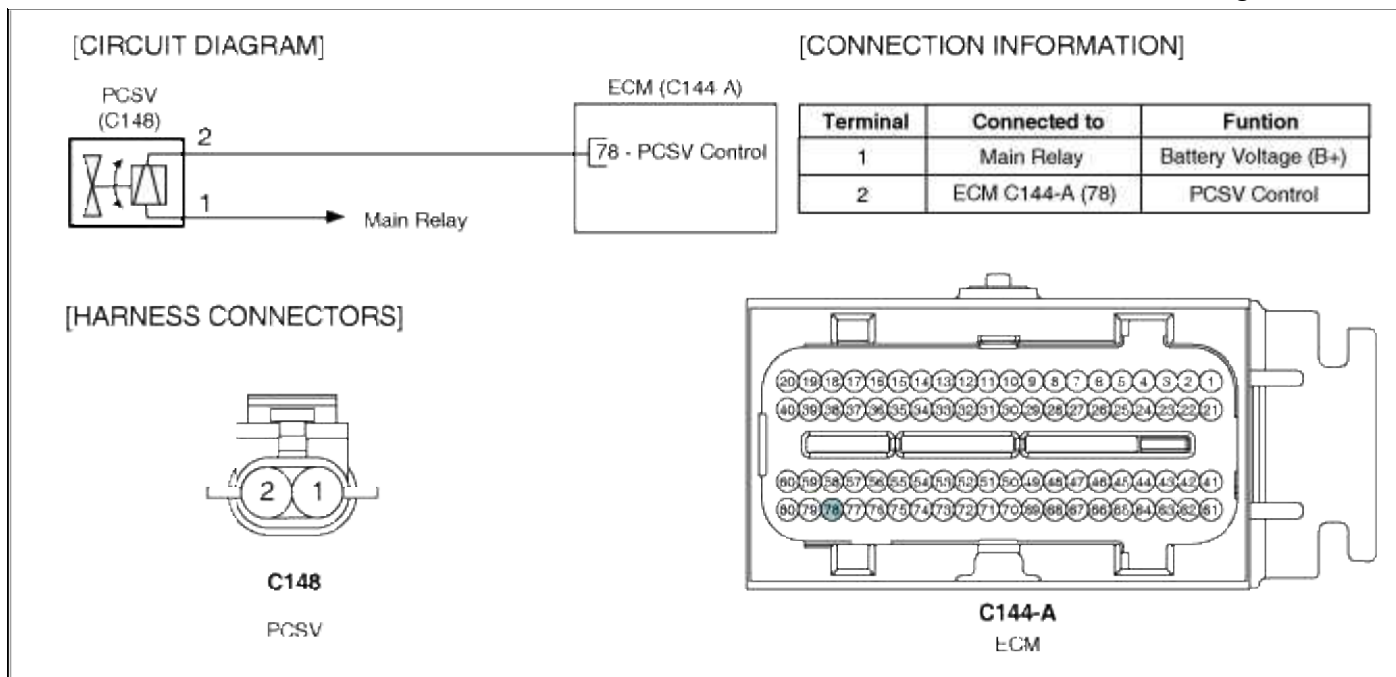
**INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the ECM grounds the valve control line. When the passage is open (PCSV ON), fuel vapor stored in the canister is transferred to the intake manifold.

**SPECIFICATION**

Item	Specification
Coil Resistance ( $\Omega$ )	19.0 ~ 22.0 $\Omega$ at 20°C (68°F)

**SCHEMATIC DIAGRAM**



### COMPONENT INSPECTION

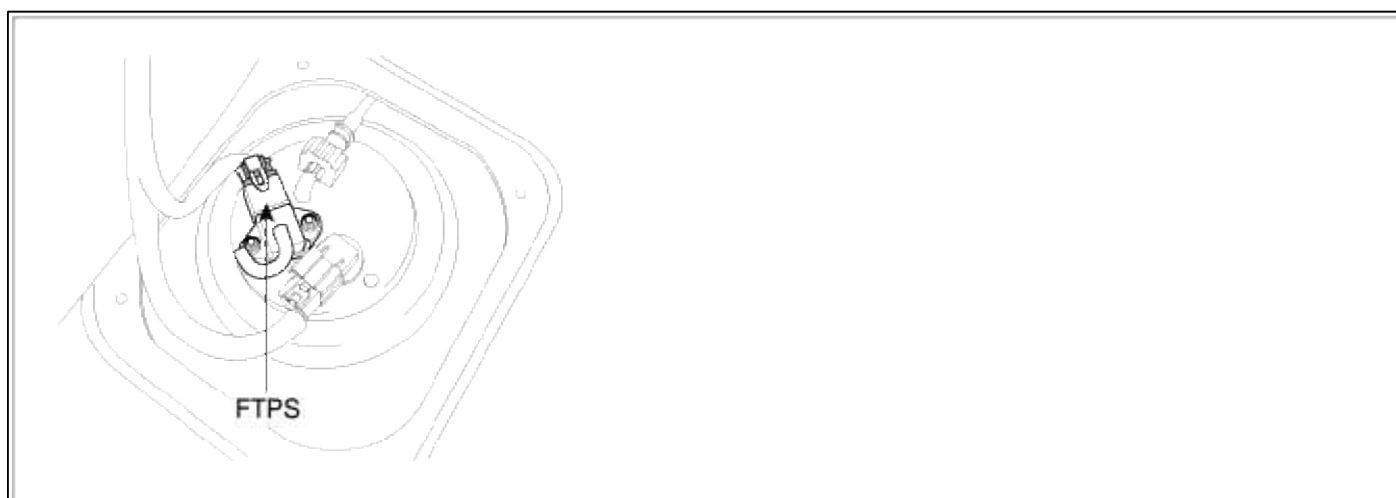
1. Turn ignition switch OFF.
2. Disconnect PCSV connector.
3. Measure resistance between PCSV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

## Emission Control System > Evaporative Emission Control System > Fuel Tank Pressure Sensor (FTPS) > Repair procedures

### INSPECTION

### FUNCTION AND OPERATION PRINCIPLE



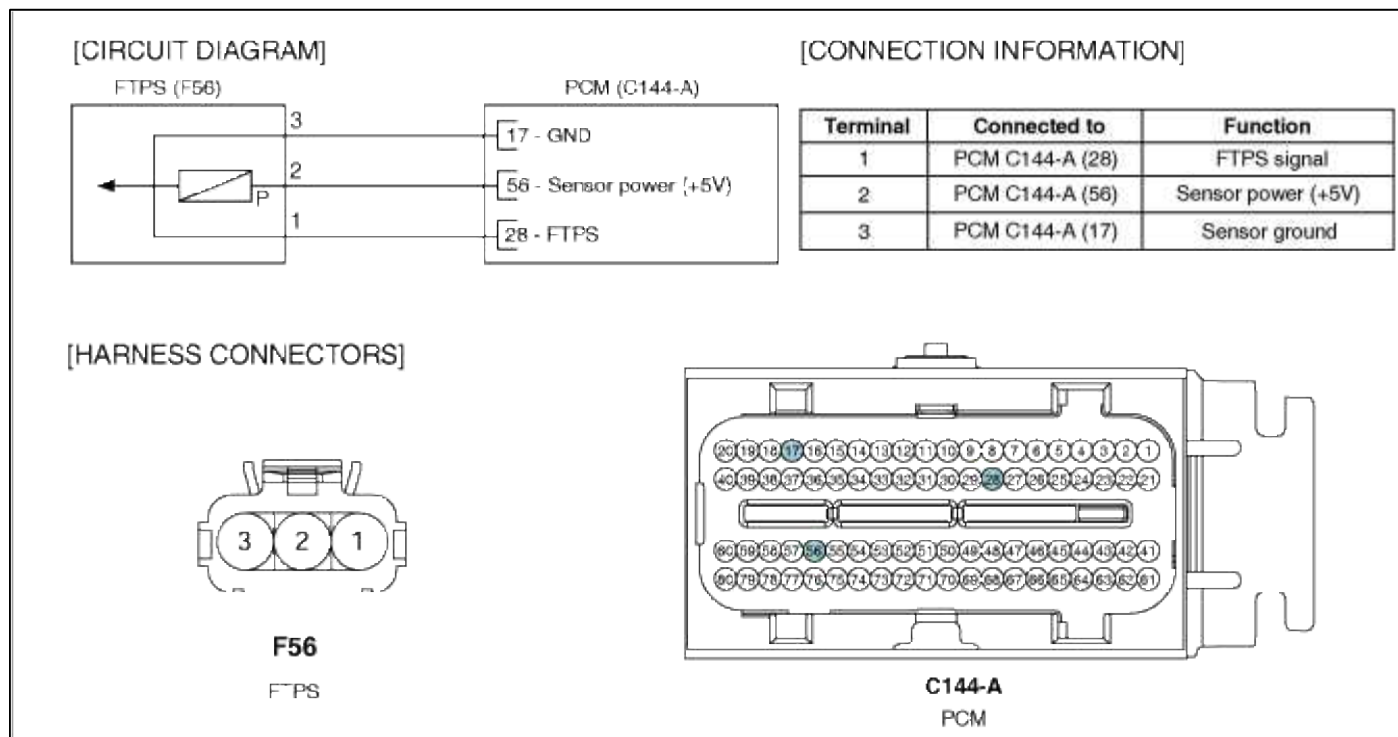
The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is installed on fuel pump assembly and is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and atmospheric air pressure to check the

purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

#### SPECIFICATION

Pressure (kPa)	Output Voltage (V)
-3.75	0.5
0	2.5
+3.75	4.5

#### SCHEMATIC DIAGRAM



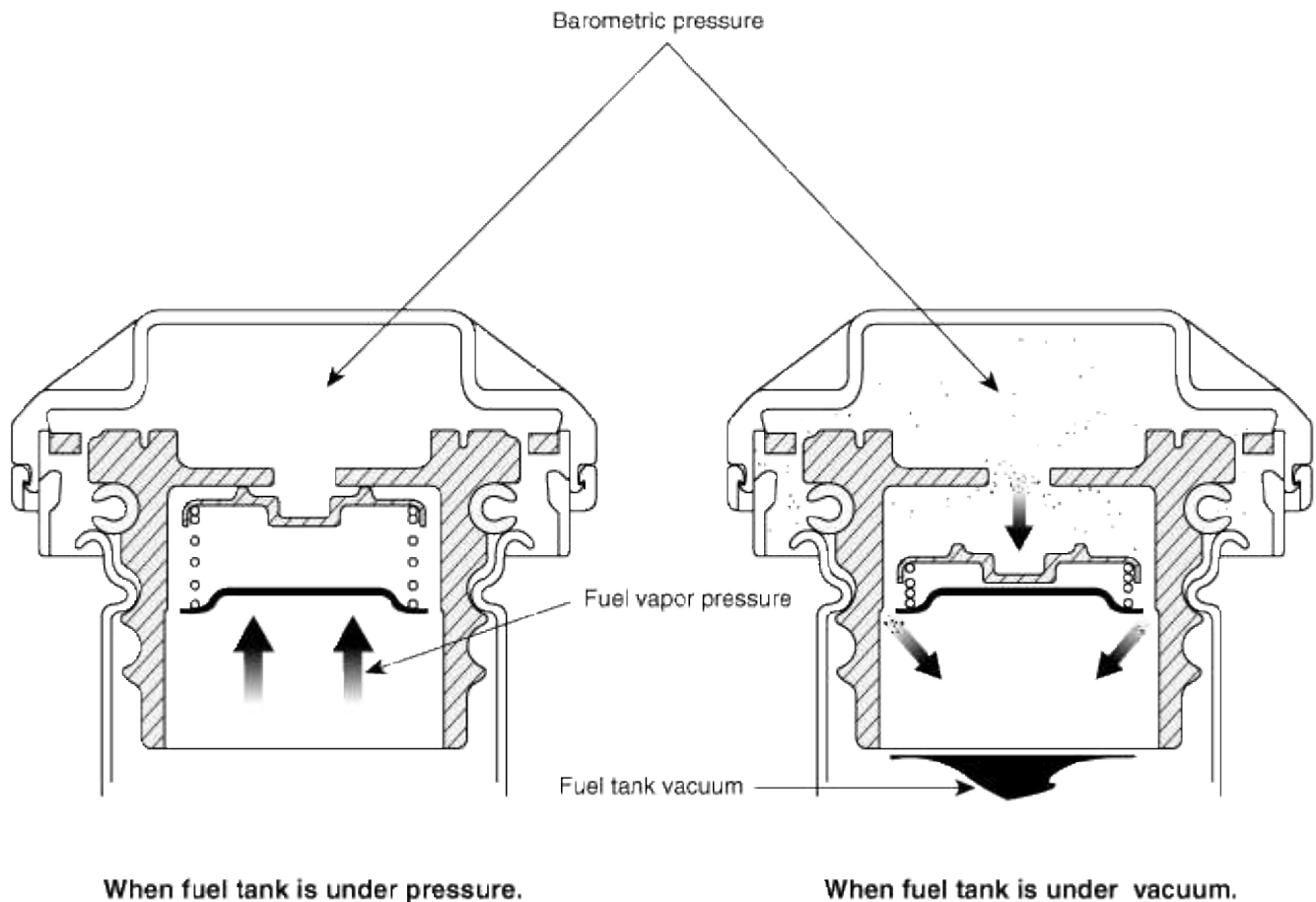
#### COMPONENT INSPECTION

1. Connect a scantool on Diagnosis connector (DLC).
2. Check FTPS output voltage at idle.

Condition	Output (V)
Idle	Approx. 2.5V

**Emission Control System > Evaporative Emission Control System > Fuel Filler Cap > Description and Operation**

#### DESCRIPTION



### Emission Control System > Exhaust Emission Control System > Description and Operation

#### DESCRIPTION

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system.

These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

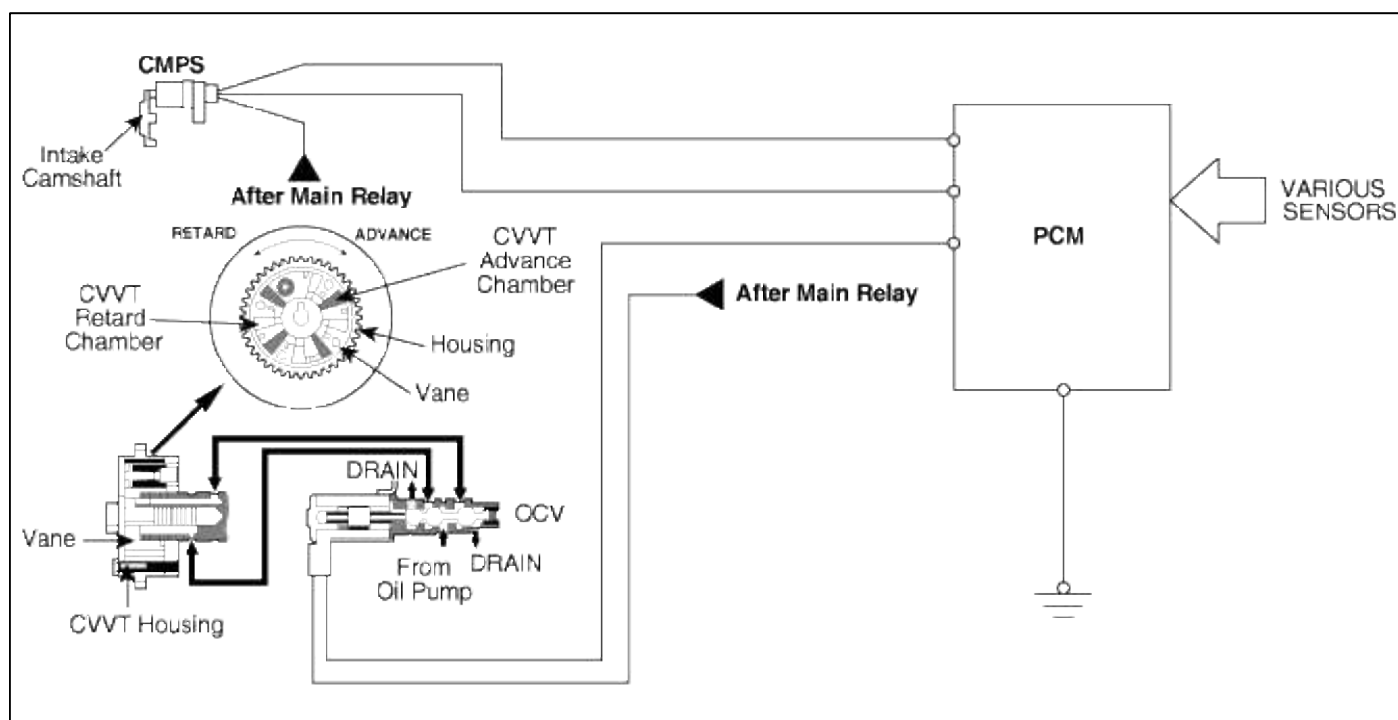
#### AIR/FUEL MIXTURE CONTROL SYSTEM [MULTIPOINT FUEL INJECTION (MFI) SYSTEM]

This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There are two operating modes in the MFI system.

1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

## Emission Control System > Exhaust Emission Control System > CVVT (Continuously Variable Valve Timing) System > Description and Operation

### DESCRIPTION



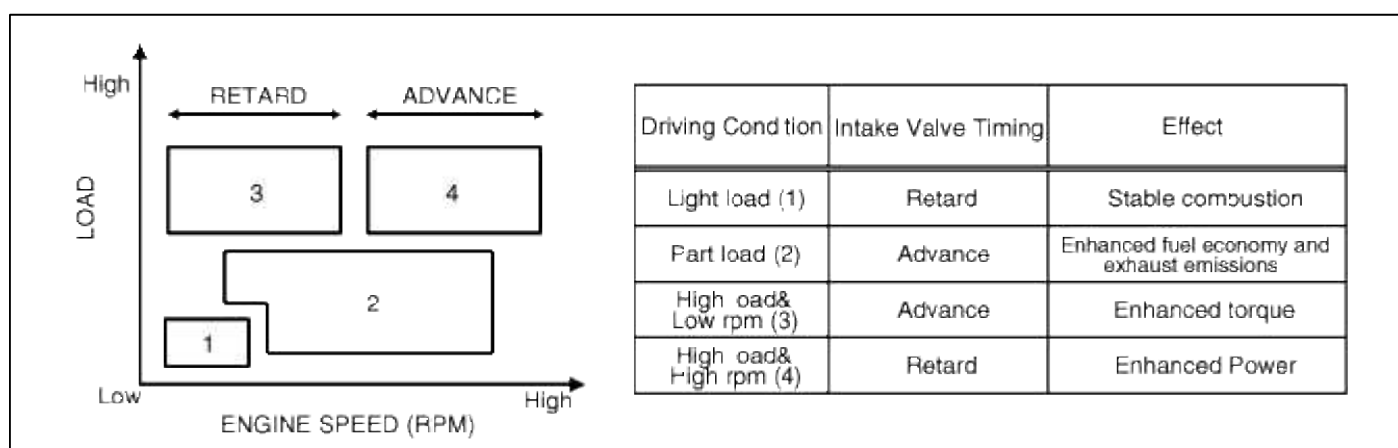
The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.

The intake valve timing is optimized by CVVT system depending on engine rpm.

This CVVT system improves fuel efficiency and reduces NOx emissions at all levels of engine speed, vehicle speed, and engine load by EGR effect because of valve over-lap optimization.

The CVVT changes the phase of the intake camshaft via oil pressure.

It changes the intake valve timing continuously.



### OPERATION

The CVVT system makes continuous intake valve timing changes based on operating conditions.

Intake valve timing is optimized to allow the engine to produce maximum power.

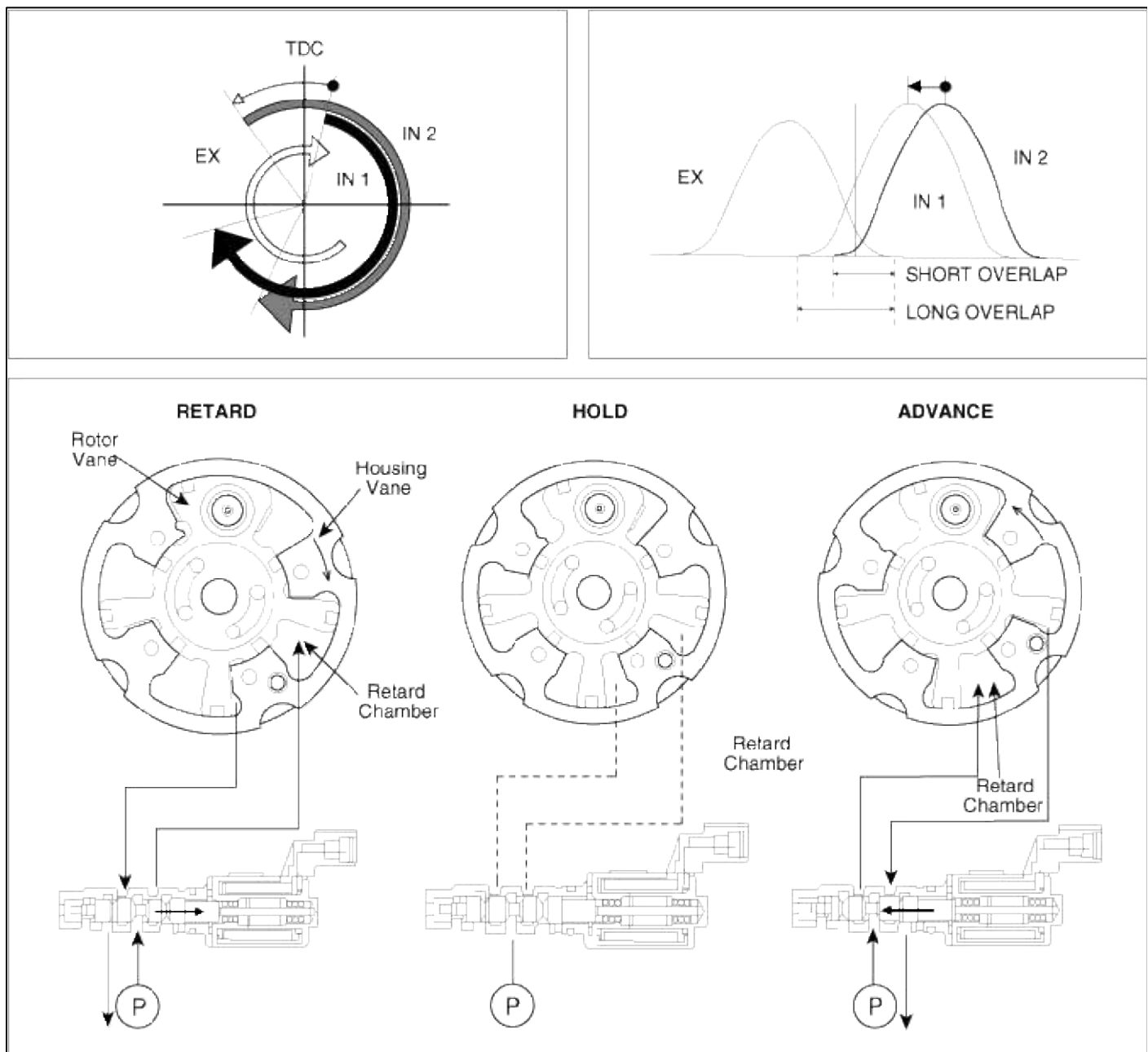
Cam angle is advanced to obtain the EGR effect and reduce pumping loss. The intake valve is closed quickly to reduce the entry of the air/fuel mixture into the intake port and improve the changing effect.

Reduces the cam advance at idle, stabilizes combustion, and reduces engine speed.

If a malfunction occurs, the CVVT system control is disabled and the valve timing is fixed at the fully retarded



position.



1. The above figure shows the relative operation structures of the housing vane to the rotor vane.
2. If the CVVT is held a certain control angle, to hold this state, oil is replenished as much as oil leaks from the oil pump.

The OCV (Oil-flow Control Valve) spool location at this time is as follows.

**Oil pump → Advance oil chamber (Little by little open the inflow side to the advance oil chamber) → Almost close the drain side**

Note that a difference may exist in the position according to the engine running state (rpm, oil temperature, and oil pressure).

### Emission Control System > Troubleshooting > P0420

#### GENERAL DESCRIPTION

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO<sub>2</sub>S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen

contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front.

### DTC DESCRIPTION

If the oxygen storage time for Bank 1 is lower than threshold , the ECM determines that a fault exists and a DTC is stored. MIL(Malfunction Indication Lamp) turns on.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch.</li> </ul>	<ul style="list-style-type: none"> <li>Catalyst Converter</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>Engine Runtime <math>\geq 580</math> sec.</li> <li>Purge Concentration Learned</li> <li><math>3 \text{ g/s} \leq \text{Airflow} \leq 10 \text{ g/s}</math></li> <li>Throttle closed <math>\leq 1.5\%</math></li> <li><math>70^{\circ}\text{C}(158^{\circ}\text{F}) \leq \text{Coolant Temp.} \leq 120^{\circ}\text{C}(248^{\circ}\text{F})</math></li> <li><math>-7^{\circ}\text{C}(19.4^{\circ}\text{F}) \leq \text{Ambient Temp.} \leq 105^{\circ}\text{C}(221^{\circ}\text{F})</math></li> <li>Barometer <math>\geq 72 \text{ kPa}</math></li> <li>Max number of test attempts <math>\leq 12</math></li> <li>Closed Loop</li> <li><math>250^{\circ}\text{C}(482^{\circ}\text{F}) \leq \text{Catalyst Temp.} \leq 950^{\circ}\text{C}(1742^{\circ}\text{F})</math></li> <li>Fuel learning completed</li> <li>Vehicle speed <math>\leq 3 \text{ kph}(1.8 \text{ mph})</math></li> <li>Not airfuel ramping</li> <li>Max idle time( about 60 sec.) not exceeded</li> <li>No disabling faults present</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Oxygen Storage Time <math>&lt; 3.25</math> sec.</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>15 sec.</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>1 Driving cycle</li> </ul>	

### MONITOR SCANTOOL DATA

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
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- (5) Is "Present" Fault displayed?

**YES**

Substitute with a known - good Catalyst Converter and check for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

## COMPONENT INSPECTION

## 1. Monitor the Catalyst Converter

- (1) Clear DTC.
- (2) Start the engine and warm it up until the radiator fan comes on( more than at least 10 minutes).
- (3) Drive at a steady speed between 45-55 mph(72-88 km/h) for 30 seconds.
- (4) Stop and then maintain idle state for 120 seconds in D-position.
- (5) Repeat step 3 once again.
- (6) Stop and then keep it in idle state( D-position) for 120 seconds.
- (7) Repeat step 3 once again.
- (8) Stop and then maintain idle state for 120 seconds in D-position.
- (9) IG "OFF"
- (10) Repeat steps 3 through 9 three times.
- (11) Check if catalyst monitoring readiness is complete. so, if the readiness is incomplete, repeat steps 2 through 10.

(12) Does the scan tool show DTC P0420?

**YES**

Substitute with a known - good Catalyst Converter and check the signal waveform of HO2S for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

**NO**

It was intermittent failure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## Emission Control System > Troubleshooting > P0430

### GENERAL DESCRIPTION

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO2S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front.

### DTC DESCRIPTION

If the oxygen storage time for Bank 2 is lower than threshold , the ECM determines that a fault exists and a DTC is stored and MIL(Malfunction Indication Lamp) turns on.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch.</li> </ul>	<ul style="list-style-type: none"> <li>Catalyst Converter</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>Engine Runtime <math>\geq 580</math> sec.</li> <li>Purge Concentration Learned</li> <li><math>3 \text{ g/s} \leq \text{Airflow} \leq 10 \text{ g/s}</math></li> <li>Throttle closed <math>\leq 1.5\%</math></li> <li><math>70^{\circ}\text{C}(158^{\circ}\text{F}) \leq \text{Coolant Temp.} \leq 120^{\circ}\text{C}(248^{\circ}\text{F})</math></li> <li><math>-7^{\circ}\text{C}(19.4^{\circ}\text{F}) \leq \text{Ambient Temp.} \leq 105^{\circ}\text{C}(221^{\circ}\text{F})</math></li> <li>Barometer <math>\geq 72 \text{ kPa}</math></li> <li>Max number of test attempts <math>\leq 12</math></li> <li>Closed Loop</li> <li><math>250^{\circ}\text{C}(482^{\circ}\text{F}) \leq \text{Catalyst Temp.} \leq 950^{\circ}\text{C}(1742^{\circ}\text{F})</math></li> <li>Fuel learning completed</li> <li>Vehicle speed <math>\leq 3 \text{ kph}(1.8 \text{ mph})</math></li> <li>Not airfuel ramping</li> <li>Max idle time( about 60 sec.) not exceeded</li> <li>No disabling faults present</li> <li>No instrumentation slews active</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Oxygen Storage Time <math>&lt; 3.25</math> sec.</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>15 sec.</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>1 Driving cycle</li> </ul>	

## MONITOR SCANTOOL DATA

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<b>1.1 DIAGNOSTIC TROUBLE CODES</b> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; height: 150px; margin: 5px 0;"></div> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 5px;"> <span>PART</span> <span>ERAS</span> <span>DTAL</span> </div>		<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>PXXXX TITLE</b> </div> <div style="margin-bottom: 10px;"> <b>1.MIL STATUS: ON/OFF</b>  <b>2.DTC STATUS: PRESENT/HISTORY</b>  <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
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(5) Is "Present" Fault displayed?

**YES**

Substitute with a known - good Catalyst Converter and check for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

## COMPONENT INSPECTION

### 1. Monitor the Catalyst Converter

(1) Clear DTC.

(2) Start the engine and warm it up until the radiator fan comes on( more than at least 10 minutes).

(3) Drive at a steady speed between 45-55 mph(72-88 km/h) for 30 seconds.

(4) Stop and then maintain idle state for 120 seconds in D-position.

(5) Repeat step 3 once again.

(6) Stop and then keep it in idle state( D-position) for 120 seconds.

(7) Repeat step 3 once again.

(8) Stop and then maintain idle state for 120 seconds in D-position.

(9) IG "OFF"

(10) Repeat steps 3 through 9 three times.

(11) Check if catalyst monitoring readiness is complete. so, if the readiness is incomplete, repeat steps 2 through 10.

(12) Does the scan tool show DTC P0430?

**YES**

Substitute with a known - good Catalyst Converter and check the signal waveform of HO2S for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

**NO**

It was intermittent failure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode

2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions

3. Read "DTC Status" parameter

4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## Emission Control System > Troubleshooting > P0441

### GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister.

The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor flow from the canister to the intake manifold.

#### DTC DESCRIPTION

Checking output signals from fuel tank pressure sensor under evap.system test, if fuel tank's vacuum is higher than prescribed threshold in ECM, ECM sets P0441.

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Monitor the fuel tank's vacuum</li> </ul>	<ul style="list-style-type: none"> <li>A leak in PCSV</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>10 V &lt; Battery voltage &lt; 16 V</li> <li>Barometric pressure &gt; 72 kPa (0.72 bar)</li> <li>Engine coolant temperature at startup - Intake air temperature at startup &lt; 6.7°C(12 °F)</li> <li>Engine coolant temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>Intake air temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>Fuel level: 15 ~ 85 %</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Fuel tank's vacuum &gt; a prescribed threshold in ECM</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>One time during Evaporative system diagnosis2 driving cycles</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>1 Driving cycle</li> </ul>	

#### MONITOR SCANTOOL DATA

##### NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool.

1. Install scan tool and IG "ON" and then clear DTC.
2. Select and press "EVAP.LEAKAGE TEST" mode in the scan tool.
3. Check if the vehicle is under test conditions as indicated below [Fig 1].

4. If OK, Start engine and restart Evap.Leakage Test again[Fig 2].

1.7 EVAP.LEAKAGE TEST
TEST CONDITION
1. IG SW:ON, ENG:STOPPED
2. NO TROUBLE CODE
3. FUEL LEVEL 5 % ~ 85 %
4. ECT BELOW 105°C
PRESS [ENTER] TO CONTINUE !

Fig. 1

1.7 EVAP.LEAKAGE TEST
TEST CONDITION
1. IG SW:ON, ENG:STOPPED
1. PLEASE RESTART EVAP LEAK TEST
2. START ENGINE
( IF TURN OFF, RESTART THIS FUNC. )
PRESS [ENTER] TO CONTINUE !

Fig. 2

5. Is the same DTC set after the Evap.leakage test with scan tool ?

**YES**

Go to "Component Inspection" procedure.

**NO**

Fault is intermittent, go to "Verification of vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Check PCSV for leakage

(1) Ignition "OFF"

(2) Disconnect the hose leading from the PCSV to the intake manifold at PCSV.

(3) Apply a vacuum at the nipple and verify that the PCSV holds vacuum.

(4) IG "ON" and perform ACTUATION TEST for PCSV with scantool(should hear a faint click from PCSV)

(5) Vacuum should be released.

(6) Repeat this procedure 4 or 5 times to ensure PCSV reliability.

(7) Is the PCSV working properly?

**YES**

It was intermittent failure., go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good PCSV and check for proper operation. If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode

2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions

3. Read "DTC Status" parameter

4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.



**Emission Control System > Troubleshooting > P0442****GENERAL DESCRIPTION**

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor flow from the canister to the intake manifold.

**DTC DESCRIPTION**

Checking output signals from fuel tank pressure sensor under evap.system test, if fuel tank's vacuum decay slope is higher than prescribed threshold in ECM, ECM sets P0442 and then MIL(Malfunction Indication Lamp) turns on.

**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Monitor the vacuum decay slope</li> </ul>	<ul style="list-style-type: none"> <li>• Leakage in each hose/fuel filler pipe</li> <li>• Leakage in CCV/ Canister/ Fuel tank /Fuel Filler Cap</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• 10 V &lt; Battery voltage &lt; 16 V</li> <li>• Barometric pressure &gt; 72 kPa (0.72 bar)</li> <li>• Engine coolant temperature at startup - Intake air temperature at startup &lt; 6.7°C(12 °F)</li> <li>• Engine coolant temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>• Intake air temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>• Fuel level: 15 ~ 85 %</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• The vacuum decay slope &gt; a prescribed threshold in ECM</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>• One time during Evaporative system diagnosis</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 1 Driving cycle</li> </ul>	

**MONITOR SCANTOOL DATA**

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">       </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b>  <b>2.DTC STATUS: PRESENT/HISTORY</b>  <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
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- (5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Go to "Evap.Leakage Test" as indicated below with scan tool.

## 2. Evap. Leakage Test

- (1) Cool the vehicle down for about two hours to prevent misdiagnosis.
- (2) Install scan tool and IG "ON" and then clear DTC.
- (3) Select and press "EVAP.LEAKAGE TEST" mode in the scan tool.
- (4) Check if the vehicle is under test conditions as indicated below [Fig 1].
- (5) If OK, Start engine and restart Evap.Leakage Test again[Fig 2].

**1.7 EVAP.LEAKAGE TEST**

**TEST CONDITION**

**1. IG SW:ON, ENG:STOPPED**  
**2. NO TROUBLE CODE**  
**3. FUEL LEVEL 5 % ~ 85 %**  
**4. ECT BELOW 105°C**

**PRESS [ENTER] TO CONTINUE !**

**Fig. 1**

**1.7 EVAP.LEAKAGE TEST**

**TEST CONDITION**

**1. IG SW:ON, ENG:STOPPED**

**1. PLEASE RESTART EVAP LEAK TEST**  
**2. START ENGINE**  
**( IF TURN OFF, RESTART THIS FUNC. )**

**PRESS [ENTER] TO CONTINUE !**

**Fig. 2**

(6) Is the same DTC set after the Evap.leakage test with scan tool ?

**YES**

Go to "System Inspection" procedure.

**NO**

Repeat "Evap.leakage test" with scan tool after cool the vehicle down sufficiently. If the same DTC isn't disp after the test, it was intermittent fault. Go to "Verification of vehicle Repair" procedure.

## SYSTEM INSPECTION

### 1. Check Fuel Filler Cap

(1) Check the Fuel Filler Cap is installed and properly tightened.

(2) Check if the Fuel Filler Cap seal is missing or damaged.

(3) Is the Fuel Filler Cap OK?

**YES**

Go to "Check vapor hoses for leakage in fuel system" as indicated below

**NO**

Replace the Fuel Filler Cap and go to "Verification of Vehicle Repair" procedure.

### 2. Check vapor hoses for leakage in fuel system

(1) Check vapor hoses between the following components for leakage:

A. Intake manifold ~ Purge control solenoid valve (PCSV)

B. Purge control solenoid valve (PCSV) ~ Canister

C. Canister ~ Canister close valve (CCV)

D. Canister ~ fuel tank

(2) Does a leak exist?

**YES**

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check fuel filler pipe for crack or leakage" as indicated below

### 3. Check fuel filler pipe for crack or leakage

(1) Check that there is crack or leakage in fuel filler pipe

(2) Is there any crack or leakage ?

**YES**

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Component inspection" procedure.

## COMPONENT INSPECTION

## 1. Check CCV for leakage

- (1) Disconnect the hose leading from the CCV to Canister at CCV.
- (2) Visually Check any tear of the hose leading from the CCV to Canister
- (3) When the CCV operates, apply a vacuum at the nipple and verify that the CCV holds vacuum.
- (4) Does a leak exist?

**YES** 

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO** 

Go to "Check Canister for leakage" as indicated below

## 2. Check Canister for leakage

- (1) Disconnect the hose leading from the CCV to Canister at Canister.
- (2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum.
- (3) Does a leak exist?

**YES** 

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO** 

Go to "Check fuel tank for leakage" as indicated below

## 3. Check fuel tank for leakage

- (1) Check fuel tank for crack or leakage.
- (2) Does a leak exist?

**YES** 

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO** 

Carefully perform this troubleshooting procedure all over again from the beginning.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES** 

System performing to specification at this time. Clear the DTC

**NO** 

Go to the applicable troubleshooting procedure.

**Emission Control System > Troubleshooting > P0444**

## COMPONENT LOCATION



## GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor from the canister to the intake manifold.

## DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating open or short to ground in the circuit are detected for more than 5 sec., ECM sets P0444. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Open, short to ground	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open or short to ground in harness</li> <li>• PCSV</li> <li>• ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• Engine running</li> <li>• <math>11\text{V} \leq \text{Battery voltage} \leq 16\text{V}</math></li> <li>• Above enable conditions are met &gt; 0.5 sec.</li> </ul>	
Threshold value	• Open or short to ground	
DiagnosisTime	<ul style="list-style-type: none"> <li>• Continuous (More than 5 sec.failure for every 10 sec.test)</li> </ul>	
MIL On Condition	• 2 driving cycles	

## SIGNAL WAVEFORM AND DATA

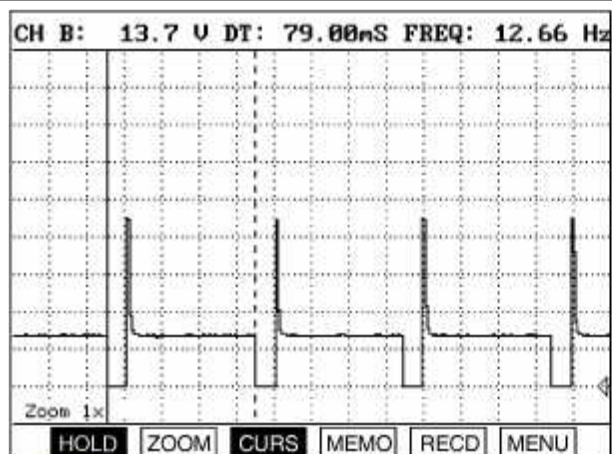


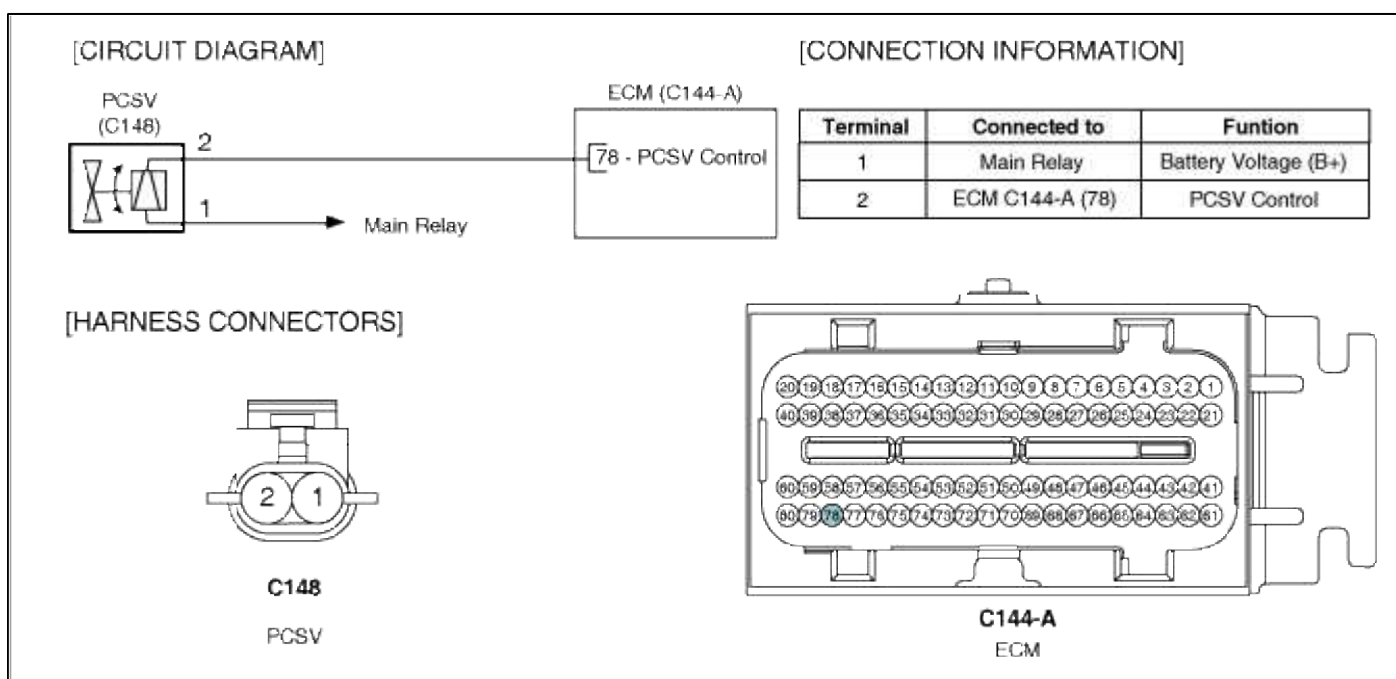
Fig. 1

The Purge Control Solenoid Valve(PCSV) is open or closed by PCM and vacuum of intake manifold.  
At opening, fuel vapor from canister enters into intake manifold.  
This photo shows the signal waveform of PCSV operating normally.

## SPECIFICATION

Item	Coil resistance( $\Omega$ )
PCSV	19.0 ~ 22.0 $\Omega$ (at 20°C / 68°F)

## SCHEMATIC DIAGRAM



## MONITOR DTC STATUS

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

## (5) Is "Present" Fault displayed?

☐ **YES**

Go to "Terminal and connector inspection" procedure.

☐ **NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

☐ **YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

☐ **NO**

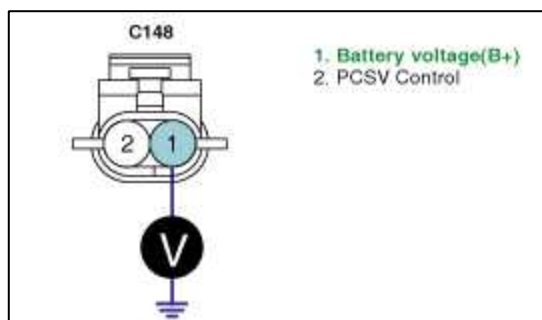
Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSEPCTION

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"

3. Measure voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+



4. Is the measured voltage within specification?

**YES**

Go to "Control Circuit Inspection" procedure.

**NO**

Repair open or short to ground in harness, and go to " Verification of Vehicle Repair" procedure.

#### CONTROL CIRCUIT INSPECTION

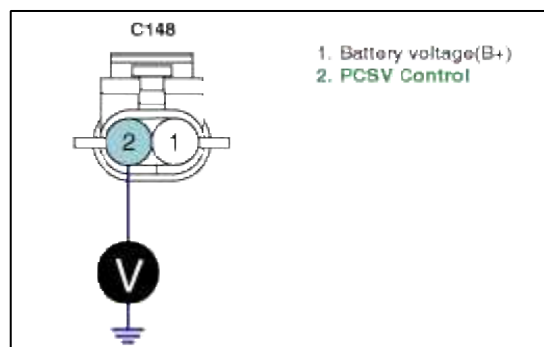
1. Check short to ground in harness.

(1) IG "OFF" and disconnect PCSV connector.

(2) IG "ON"

(3) Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0 V



(4) Is the measured voltage within specification?

**YES**

Go to "Check open in harness" as follows.

**NO**

Repair short to ground in harness, and go to " Verification of Vehicle Repair" procedure.



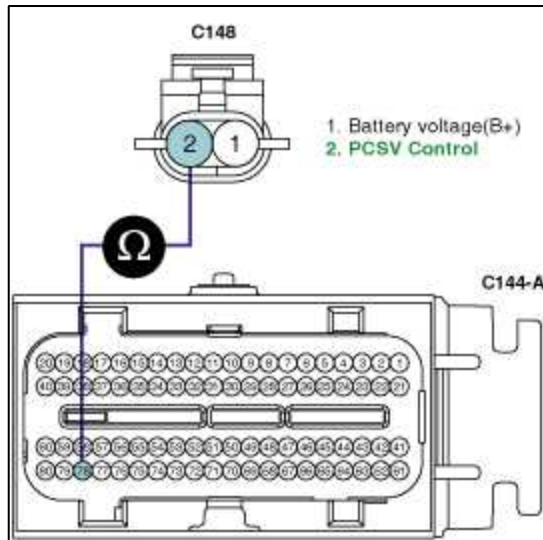
## 2. Check open in harness.

- (1) IG "OFF" and disconnect PCSV connector and ECM connector.
- (2) Measure resistance between terminal 2 of PCSV harness connector and terminal 78 of ECM harness connector(C144-A).

---

Specification : Below 1Ω

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

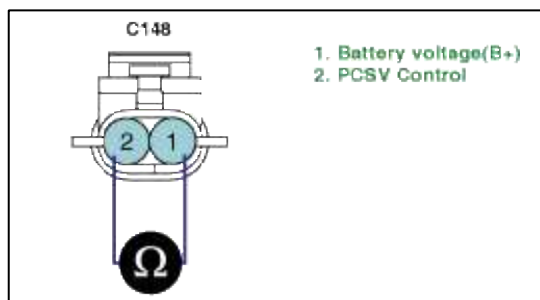
## COMPONENT INSPECTION

### 1. Check PCSV

- (1) IG "OFF" and disconnect PCSV connector.
- (2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

**Specification :**

Item	Coil resistance(Ω)
PCSV	19.0 ~ 22.0Ω (at 20°C / 68°F)



(3) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation.

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good PCSV and check for proper operation.

If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

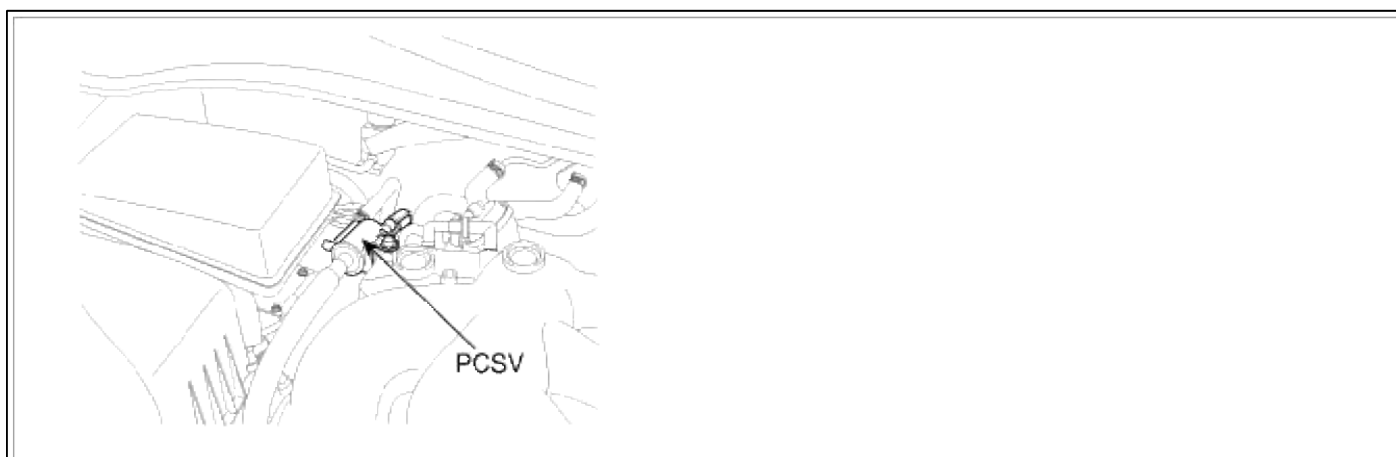
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## Emission Control System > Troubleshooting > P0445

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor from the canister to the intake manifold.

## DTC DESCRIPTION

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating short to battery in the circuit are detected for more than 5 sec., ECM sets P0445. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Short to battery	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Short to battery in harness</li> <li>• PCSV</li> <li>• ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> <li>• Above enable conditions are met <math>&gt; 0.5</math> sec.</li> </ul>	
Threshold value	• Short to battery	
DiagnosisTime	<ul style="list-style-type: none"> <li>• Continuous (More than 5 sec.failure for every 10 sec.test)</li> </ul>	
MIL On Condition	• 2 driving cycles	

## SIGNAL WAVEFORM AND DATA

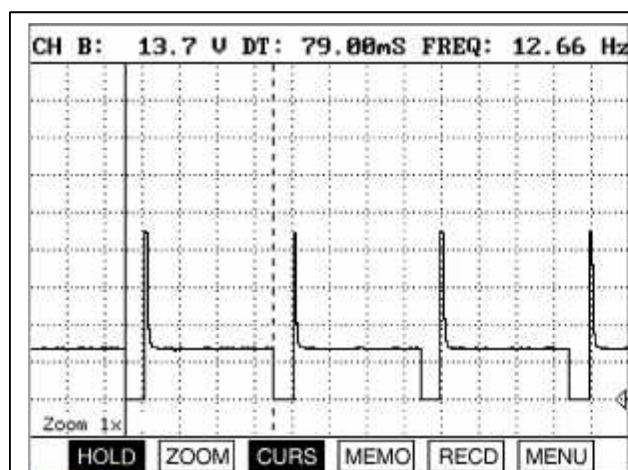


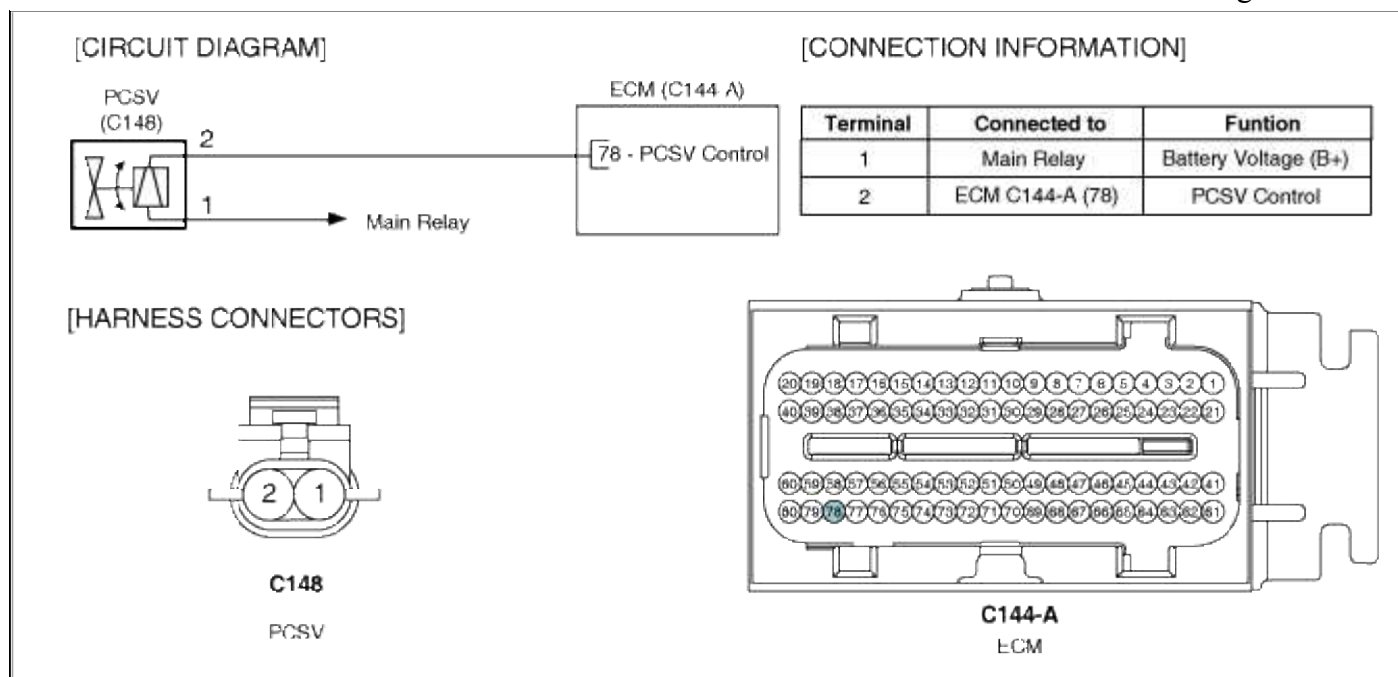
Fig. 1

The Purge Control Solenoid Valve(PCSV) is open or closed by PCM and vacuum of intake manifold. At opening, fuel vapor from canister enters into intake manifold. To prevent vacuum from forming inside canister, PCM controls to open it. This photo shows the signal waveform of PCSV operating normally.

## SPECIFICATION

Item	Coil resistance( $\Omega$ )
PCSV	19.0 ~ 22.0 $\Omega$ (at 20°C / 68°F)

## SCHEMATIC DIAGRAM



## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		PXXXX TITLE
PXXXX DTC TITLE		
<p>1. MIL STATUS: ON/OFF</p> <p>2. DTC STATUS: PRESENT/HISTORY</p> <p>3. DIAG. STATUS: DIAGNOSIS FINISHED</p>		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL
DTC CAUSE TO SYSTEM ERROR : PXXXX		

### (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

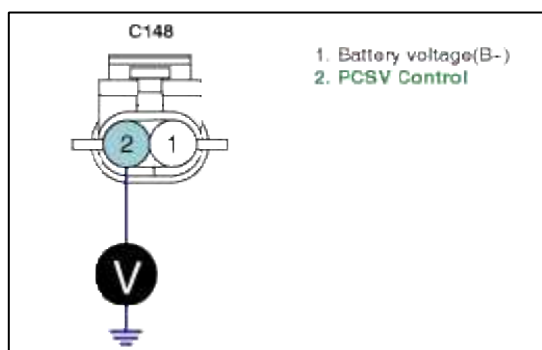
**NO**

Go to "Control Circuit Inspection" procedure.

### CONTROL CIRCUIT INSPECTION

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0 V



4. Is the measured voltage within specification?

**YES**

Go to "Component Inspection" procedure.

**NO**

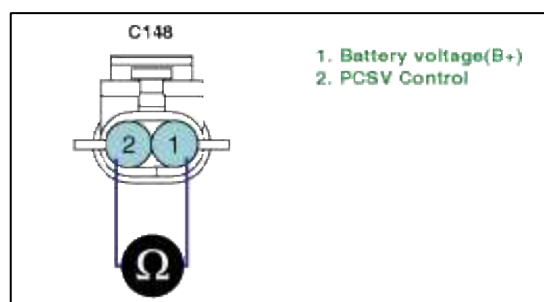
Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

### COMPONENT INSPECTION

1. Check PCSV
  - (1) IG "OFF" and disconnect PCSV connector.
  - (2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

**Specification :**

Item	Coil resistance( $\Omega$ )
PCSV	19.0 ~ 22.0 $\Omega$ (at 20°C / 68°F)



(3) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation.

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good PCSV and check for proper operation.

If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

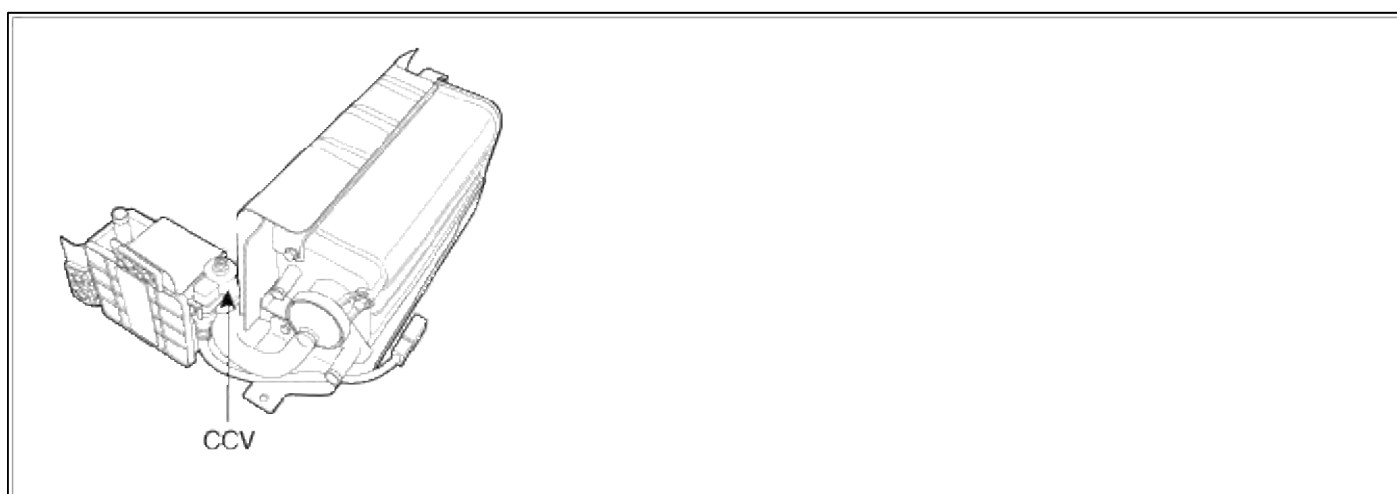
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## Emission Control System > Troubleshooting > P0447

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The evaporative emissions system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

## DTC DESCRIPTION

Checking output signals from CCV every 10 sec. under detecting condition, if signals indicating open or short to ground in the circuit are detected for more than 5 sec., ECM sets P0447. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

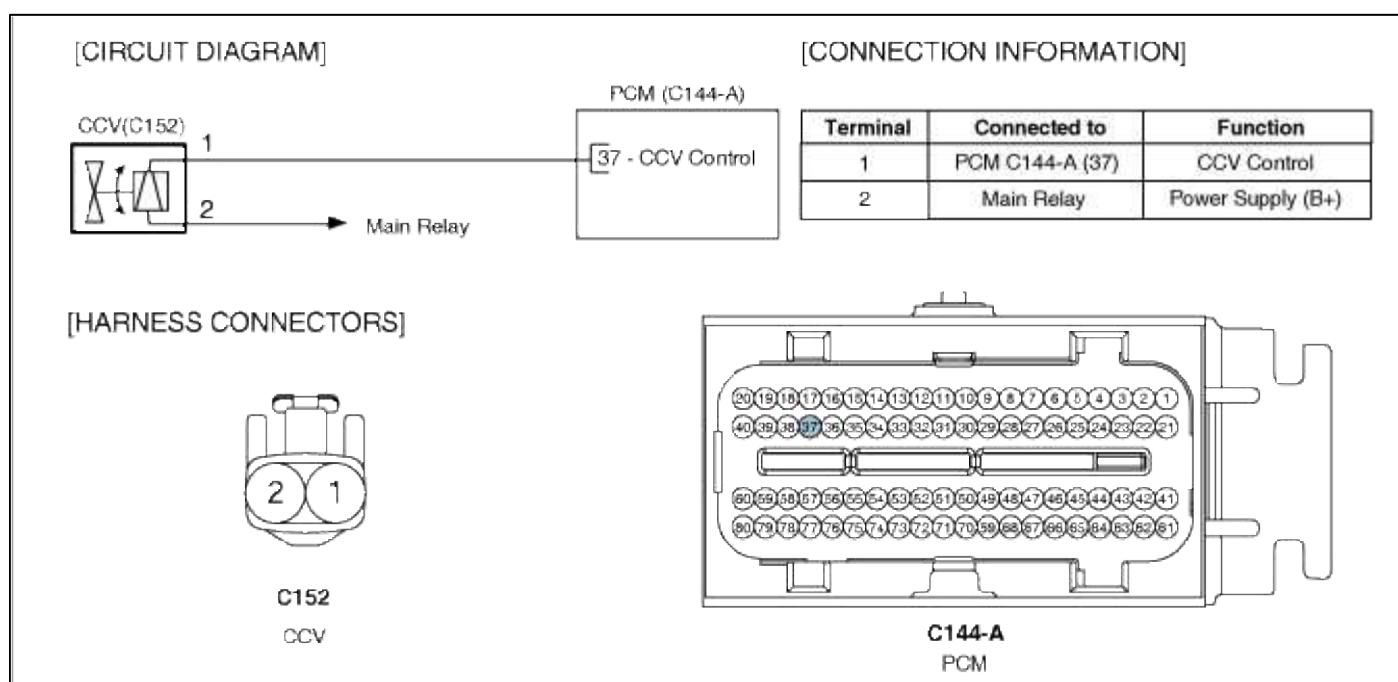
## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Detects a short to ground or open circuit</li> </ul>	<ul style="list-style-type: none"> <li>Poor Connection</li> <li>Open or Short in Power Circuit</li> <li>Open or Short in Control Circuit</li> <li>CCV</li> <li>ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>Engine Running</li> <li><math>11V \leq \text{Ignition Voltage} \leq 16V</math></li> <li>Enable Time delay <math>\geq 0.5\text{sec.}</math></li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Open or short to ground</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>Continuous (More than 5sec. Test failure for every 10sec. tests)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## SPECIFICATION

Item	Specification
Coil Resistance( $\Omega$ )	15.5 ~ 18.5 $\Omega$ at 20°C(68°F)

## SCHEMATIC DIAGRAM



## MONITOR DTC STATUS

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

## (5) Is "Present" Fault displayed?

☐ **YES**

Go to "Terminal and Connector inspection" procedure.

☐ **NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

☐ **YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

☐ **NO**

Go to " Power Circuit Inspection " procedure

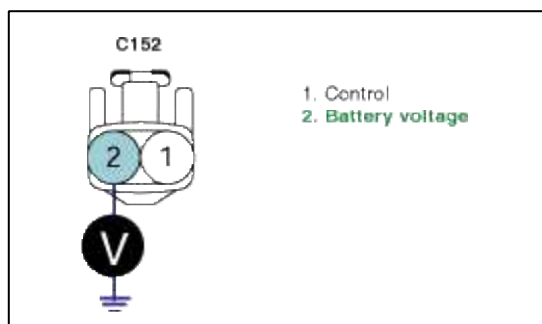
## POWER CIRCUIT INSPECTION

1. Engine "OFF"
2. Disconnect CCV connector
3. Ignition " ON " & Engine "OFF"



4. Measure voltage between terminal "2" of CCV harness connector and chassis ground.

Specification : B+



5. Is the measured voltage within specifications?

**YES**

Go to "Control Circuit Inspection" procedure.

**NO**

Check open or short to ground in harness between control relay and CCV.

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

### CONTROL CIRCUIT INSPECTION

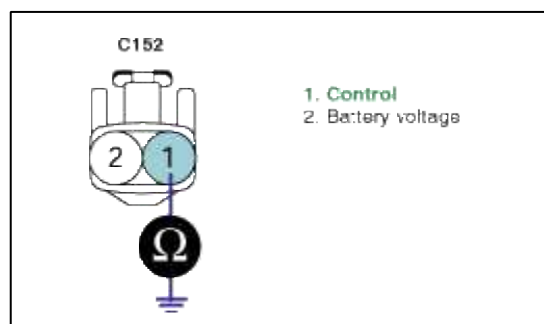
1. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect CCV connector

(3) Measure resistance between terminal "1" of CCV harness connector and chassis ground.

Specification : Infinite



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for open in harness" as indicated below.

**NO**

Check short to ground in signal harness

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

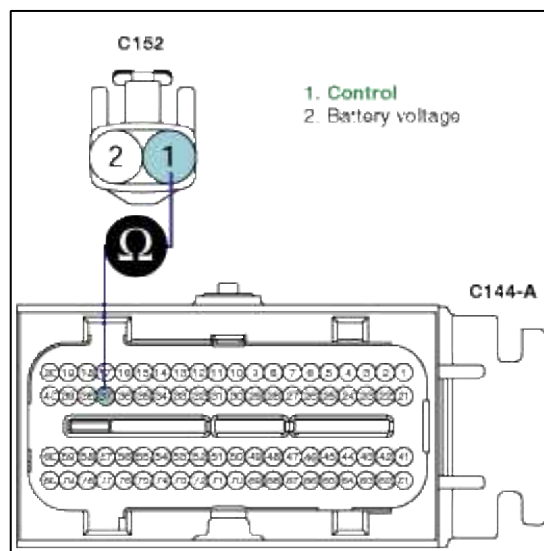
## 2. Check for open in harness

- (1) Ignition "OFF"
- (2) Disconnect CCV and ECM connector
- (3) Measure resistance between terminal "1" of CCV harness connector and terminal "37" of ECM harness connector(C144-A).

---

Specification : Approx. below 1Ω

---



- (4) Is the measured resistance within specifications?

**YES**

Go to " Component Inspection " procedure.

**NO**

Check open in harensse between CCV connector and ECM connector.

Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

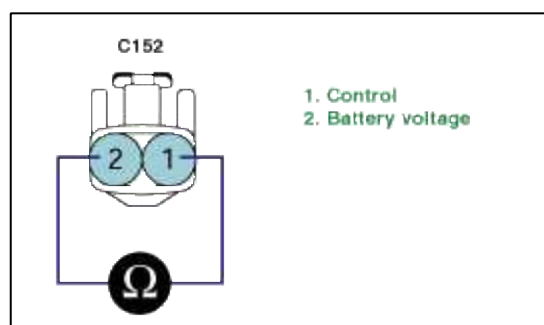
## 1. Check CCV

- (1) Ignition "OFF"
- (2) Measure resistance between terminals "1" and "2" of the CCV connector.

---

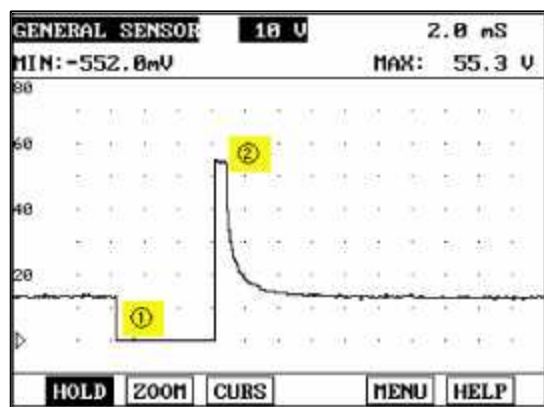
Specification: Approx. 15.5 ~ 18.5 Ω (20°C(68°F))

---



- (3) Monitor the CCV signal waveform and verify that the ground voltage is less than approx. 0.3V (①) and the surge voltage (②) is between 40 V and 60 V.

(4) Is the measured resistance within specification?



(5) Is the CCV normal?

**YES**

Substitute with a known - good ECM and check for proper operation.

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good CCV and check for proper operation.

If the problem is corrected, replace CCV and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

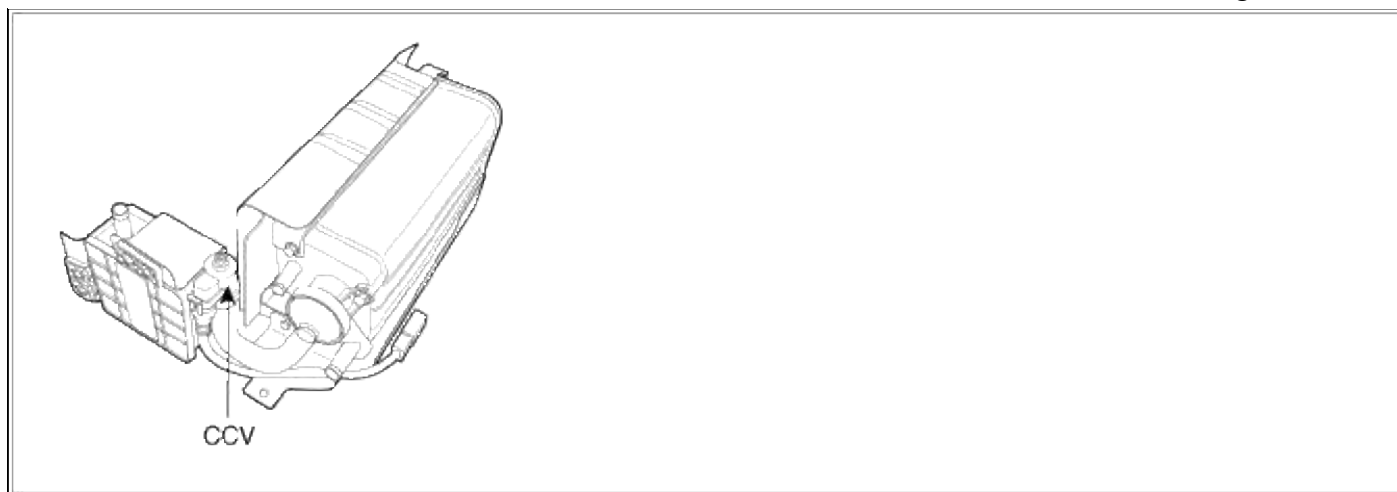
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## Emission Control System > Troubleshooting > P0448

### COMPONENT LOCATION



## GENERAL DESCRIPTION

The evaporative emissions system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

## DTC DESCRIPTION

Checking output signals from CCV every 10 sec. under detecting condition, if signals indicating short to battery in the circuit are detected for more than 5 sec., ECM sets P0448. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

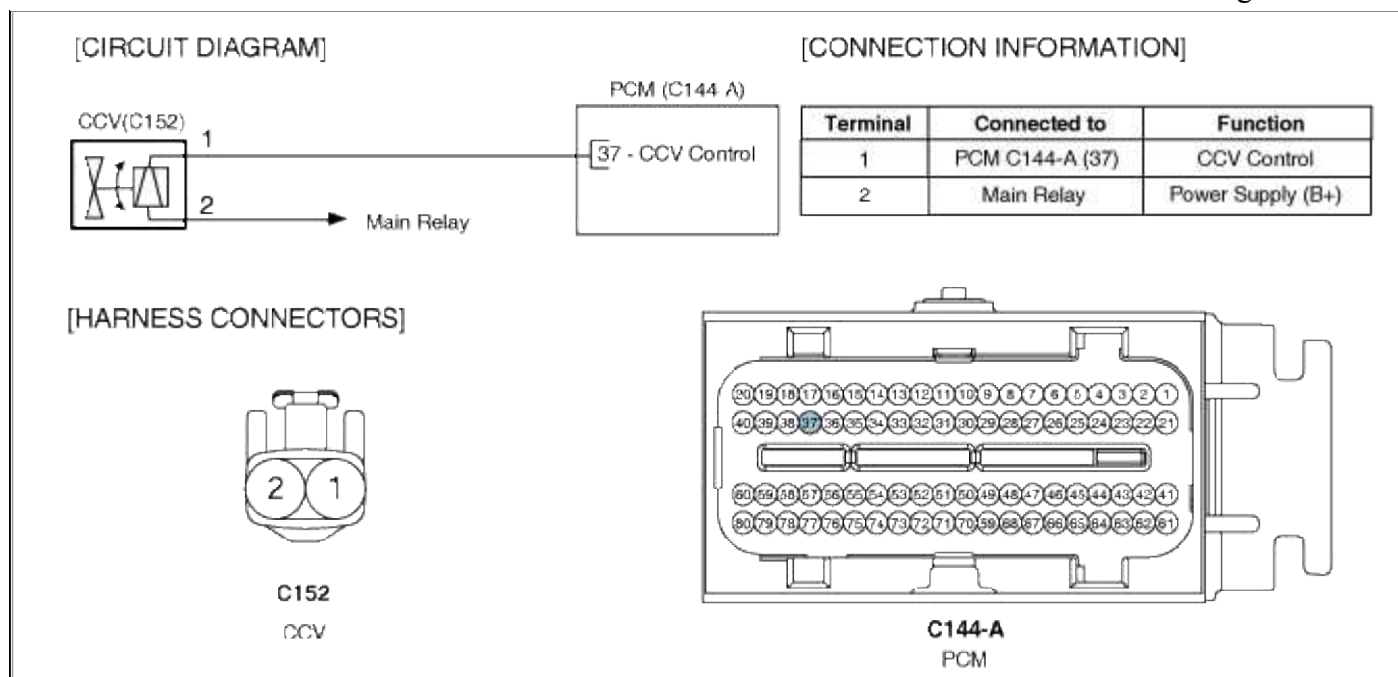
## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• DeDetects a short to battery</li> </ul>	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Short to battery in CCV circuit</li> <li>• Faulty CCV</li> <li>• Faulty ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• Engine Running</li> <li>• <math>11V \leq \text{Ignition Voltage} \leq 16V</math></li> <li>• Enable Time delay <math>\geq 0.5\text{sec.}</math></li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Short to battery</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>• Continuous (More than 5sec.Test failure for every 10sec. tests)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 2 driving cycles</li> </ul>	

## SPECIFICATION

Item	Specification
Coil Resistance( $\Omega$ )	15.5 ~ 18.5 $\Omega$ at 20°C(68°F)

## SCHEMATIC DIAGRAM



## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		PXXXX TITLE
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS PART ERAS DTAL		1.MIL STATUS: ON/OFF 2.DTC STATUS: PRESENT/HISTORY 3.DIAG.STATUS: DIAGNOSIS FINISHED  DTC CAUSE TO SYSTEM ERROR : PXXXX

### (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and Connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Control Circuit Inspection" procedure

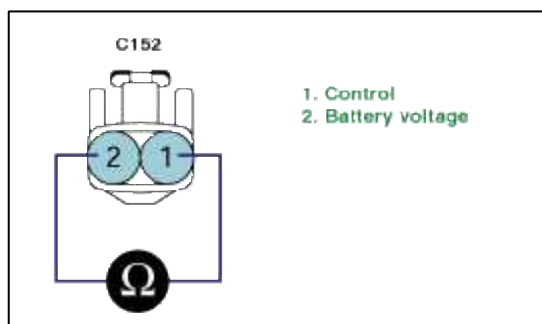
## CONTROL CIRCUIT INSPECTION

1. Check for short to battery in harness
  - (1) Ignition "OFF"
  - (2) Disconnect CCV connector
  - (3) Measure resistance between terminal "2" and "1" of CCV harness connector.

---

Specification : Infinite

---



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check short to battery in harness.

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check CCV

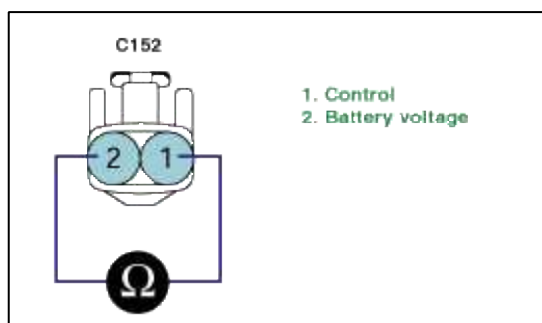
(1) Ignition "OFF"

(2) Measure resistance between terminals "1" and "2" of the CCV connector.

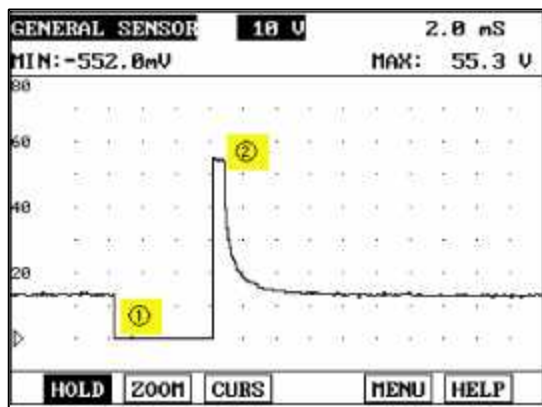
---

 Specification: Approx. 15.5 ~ 18.5  $\Omega$  (20°C(68°F))
 

---



(3) Monitor the CCV signal waveform and verify that the ground voltage is less than approx. 0.3V (①) and the surge voltage (②) is between 40 V and 60 V.



(4) Is the CCV normal?

**YES**

Substitute with a known - good ECM and check for proper operation.

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure,

**NO**

Substitute with a known - good CCV and check for proper operation.

If the problem is corrected, replace CCV and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

**VERIFICATION OF VEHICLE REPAIR**

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter

4. Is "History (Not Present)" fault displayed?

**YES**

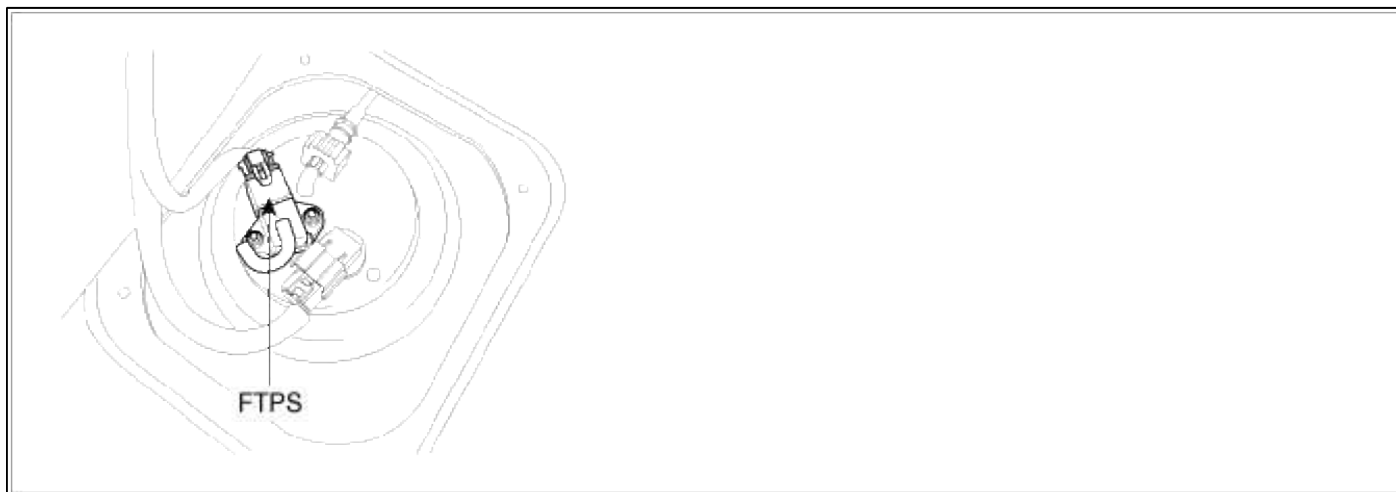
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

### Emission Control System > Troubleshooting > P0451

#### COMPONENT LOCATION



#### GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

#### DTC DESCRIPTION

Checking output signals of tank pressure under detecting condition, if the tank pressure does not change less than 0.2(0.05V) within 3min. , ECM sets P0451. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

#### DTC DETECTING CONDITION

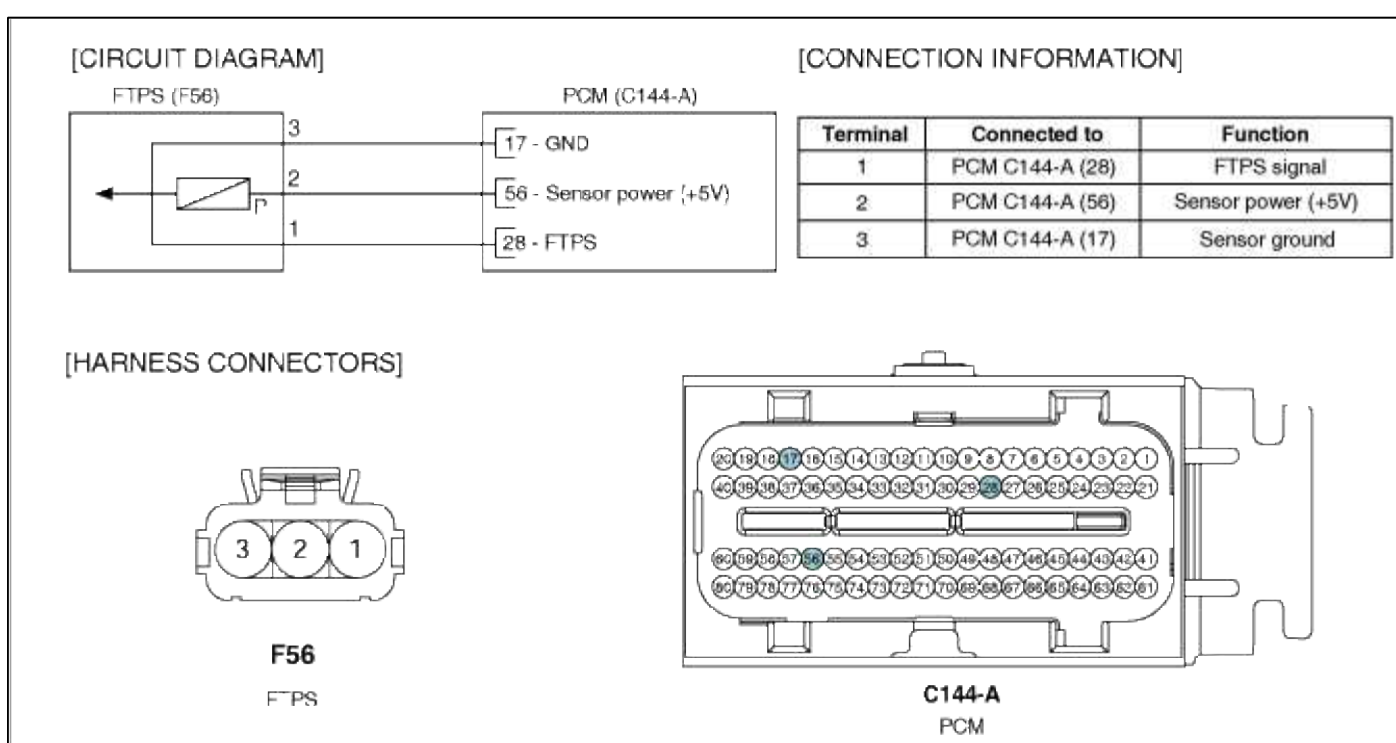


Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>• DeDetects a short to battery</li> </ul>	<ul style="list-style-type: none"> <li>• Hose between Canister and Tank is not connected.</li> <li>• Faulty FTPS</li> </ul>
Enable Conditions	Case 1	<ul style="list-style-type: none"> <li>• Engine Coolant Temperature <math>\geq 60^{\circ}\text{C}</math> (Fully Warmed up state)</li> <li>• <math>600\text{rpm} &lt; \text{Engine Speed} &lt; 3000\text{rpm}</math></li> </ul>	
	Case 2	<ul style="list-style-type: none"> <li>• During the EVAP. Monitoring</li> </ul>	
Threshold value	Case 1	<ul style="list-style-type: none"> <li>• Pressure change in tank <math>&lt; 0.2</math> (0.05V)</li> </ul>	
	Case 2	Before large leak monitoring has completed <ul style="list-style-type: none"> <li>• Pressure sensor is detected as sticking condition</li> <li>• Pressure change in tank <math>&lt; 0.2</math> (0.05V)</li> </ul>	
DiagnosisTime		<ul style="list-style-type: none"> <li>• Continuous (Within 3min : Before EVAP. Monitoring has completed )</li> </ul>	
MIL On Condition		<ul style="list-style-type: none"> <li>• 2 driving cycles</li> </ul>	

## SPECIFICATION

Pressure(kPa)	Output Voltage(V)
-3.75	0.5
0	2.5
3.75	4.5

## SCHEMATIC DIAGRAM



## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 20px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

### (5) Is "Present" Fault displayed?

**YES**

Check that hose between canister and tank is correctly connected and undamaged.  
Repair or replace as necessary and then, go to "Component Inspection" procedure.

**NO**

Fault is intermittent caused by ECM memory was not cleared after repair.  
Erase DTC and go to " Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to " Component Inspection " procedure

## COMPONENT INSPECTION

1. IG "OFF" & connect scantool.

2. ENG "ON" and Race the accelerator pedal at idle and Monitor "FTPS" parameter is changing while PCSV is operating on the service data.

Specification : Fuel Tank Pressure is O.K if pressure changes more than 0.2 while racing accelerator pedal.

1.11 CURRENT DATA		52765
* FUEL TANK PRESS SENSOR	ON	
* FUEL LEVEL SENSOR	ON	
* FUEL TANK PRESSURE	0.5	
* FUEL LEVEL	16.9 %	
O2 VOLTAGE-B1S2	1.3 V	
O2 VOLTAGE-B2S1	0.7 V	
O2 VOLTAGE-B2S2	1.1 V	
VIS 1 OPERATION STATUS	ON	
FIX		SCRN FULL PART GRPH HELP

3. Does the FTPS change while racing the accelerator pedal at idle ?

**YES**

Fault is intermittent. Drive the vehicle to satisfy the enable condition then, go to "Verification of Vehicle Repair" procedure

**NO**

Substitute with a known - good FTPS and check for proper operation. If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## Emission Control System > Troubleshooting > P0452

### COMPONENT LOCATION



## GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

## DTC DESCRIPTION

Checking output signals of fuel tank pressure sensor under detecting condition, if the tank pressure is lower than threshold, ECM sets P0452. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

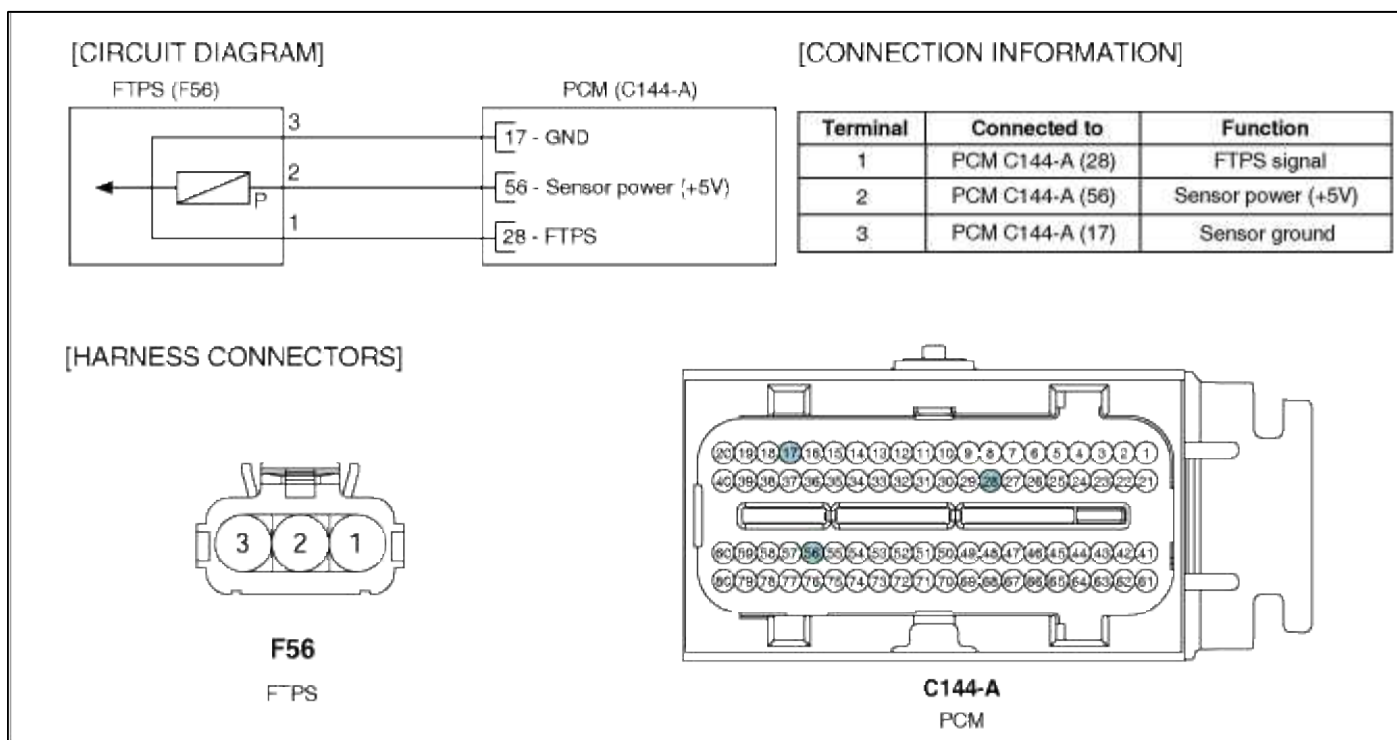
## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects the signal short to low voltage	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open in Power Circuit</li> <li>• Open or short to ground in signal Circuit</li> <li>• Faulty FTPS</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	• Ignition ON	
Threshold value	• Raw Tank Pressure < 0.086V	
DiagnosisTime	• Continuous	
MIL On Condition	• 2 driving cycles	

## SPECIFICATION

Pressure(kPa)	Output Voltage(V)
-3.75	0.5
0	2.5
3.75	4.5

## SCHEMATIC DIAGRAM



## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu

(4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

(5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and Connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

- Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

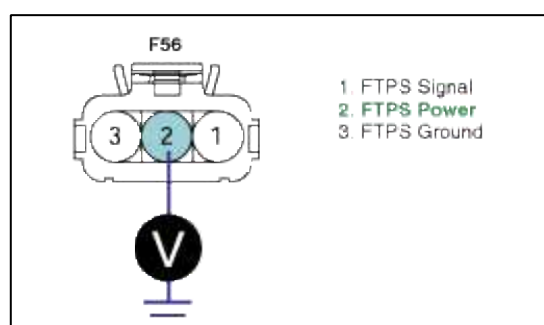
**NO**

Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSPECTION

- IG "OFF" and disconnect FTPS connector.
- IG "ON" & ENG "OFF"
- Measure voltage between terminal 2 of FTPS harness connector and chassis ground.

Specification : Approx. 5V



4. Is the measured voltage within specification ?

**YES**

ReGo to "Signal Circuit Inspection" procedure.

**NO**

Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Check voltage

(1) IG "OFF" and disconnect FTPS connector.

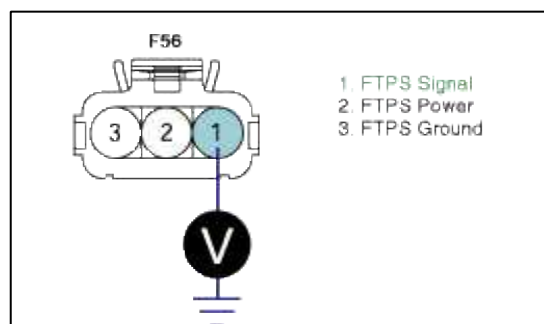
(2) IG "ON" & ENG "OFF"

(3) Measure voltage between terminal 1 of FTPS harness connector and chassis ground.

---

Specification : Approx. 0V

---



(4) Is the measured voltage within specification ?

**YES**

Go to "Check open in harness" as follows.

**NO**

Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

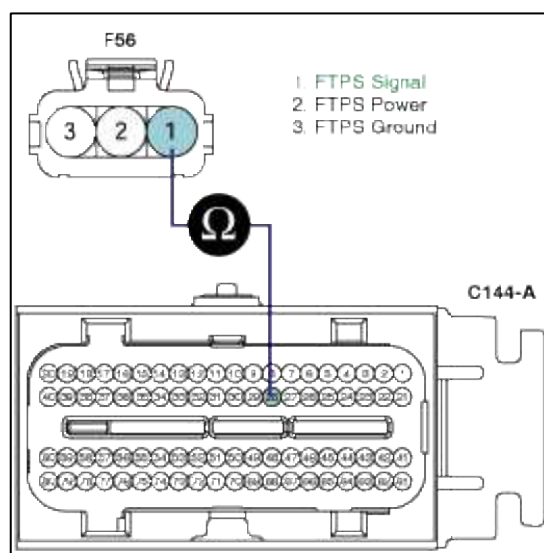
(1) IG "OFF" and disconnect FTPS and ECM connector.

(2) Measure resistance between terminal 1 of FTPS harness connector and terminal 28 of ECM harness connector(C144-A).

---

Specification : Approx. Below 1  $\Omega$

---



(3) Is the measured resistance within specification ?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair open in harness and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. Check FTPS

(1) IG "OFF" and connect scantool to DLC(Data Link Connector).

(2) Monitor "FTPS" parameter on service data

#### Specifcaton :

Pressure(kPa)	Output Voltage(V)
-3.75	0.5
0	2.5
3.75	4.5

(3) Is the "FTPS" parameter on the service data O.K ?

**YES**

Go to "Check ECM" as follows.

**NO**

Substitute with a known - good FTPS and check for proper operation. If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

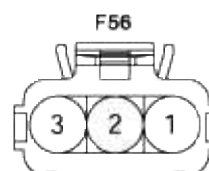
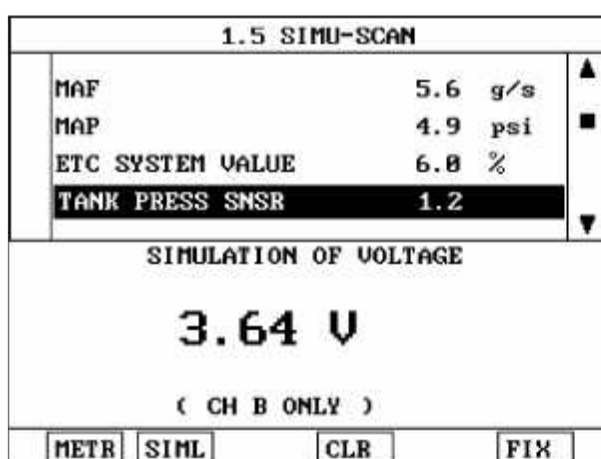
### 2. Check ECM

(1) IG "OFF" disconnect FTPS connector

(2) Connect Scantool and IG "ON" & ENG "OFF"

(3) Select simulation function on scantool.

(4) Simulate voltage at terminal 1 of FTPS harness connector.



- 1. FTPS Signal
- 2. FTPS Power
- 3. FTPS Ground



(5) Does the signal value of FTPS sensor change according to simulation voltage ?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorated damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. Before or after testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

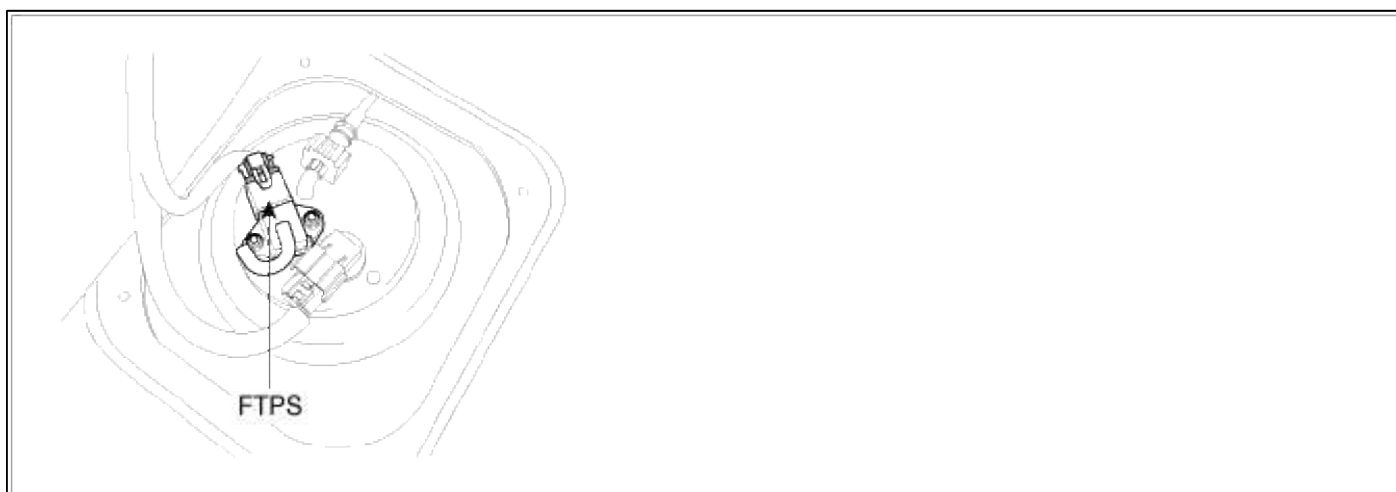
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## Emission Control System > Troubleshooting > P0453

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank

during the purge control solenoid valve operating cycles.

#### DTC DESCRIPTION

Checking output signals of fuel tank pressure sensor under detecting condition, if the tank pressure is higher than threshold, ECM sets P0453. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

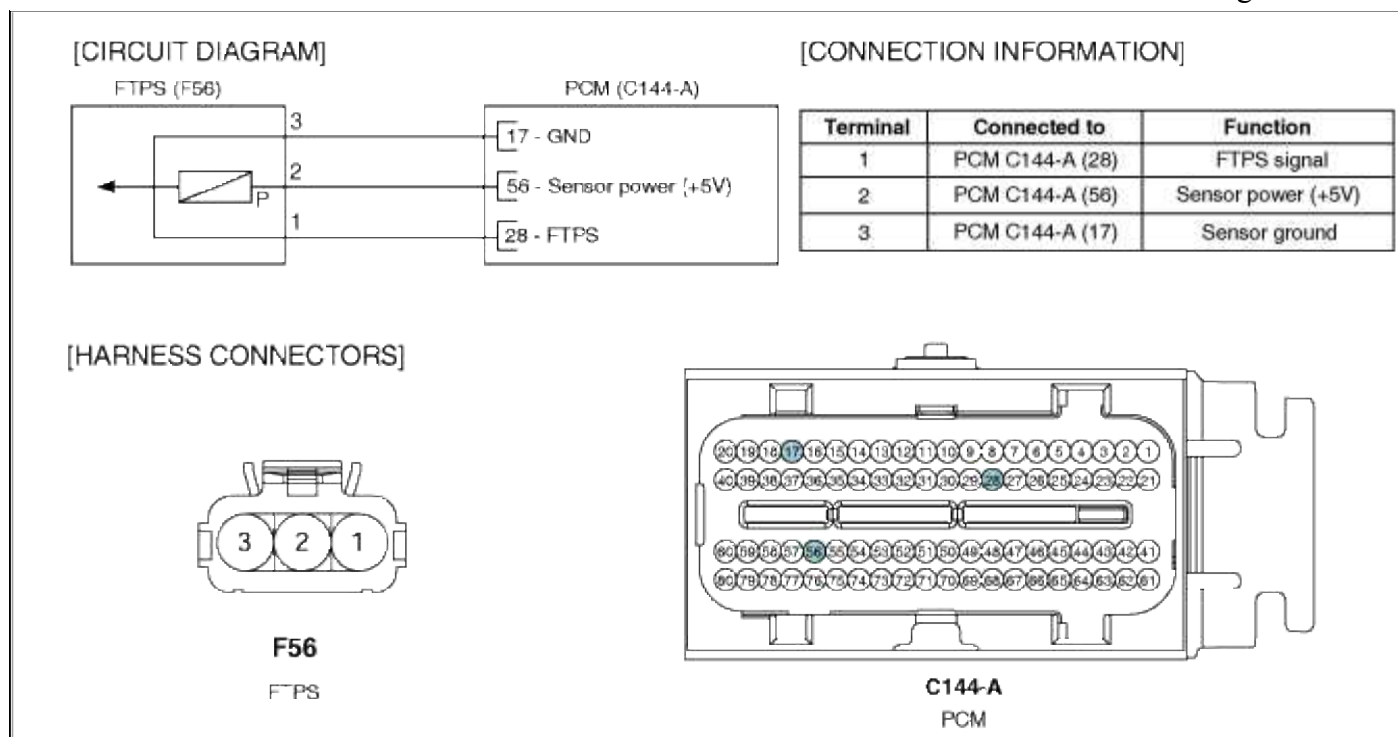
#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects short to high voltage	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Short to battery in signal Circuit</li> <li>• Faulty FTPS</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	• Ignition ON	
Threshold value	• Raw Tank Pressure > 4.915V	
DiagnosisTime	• Continuous	
MIL On Condition	• 2 driving cycles	

#### SPECIFICATION

Pressure(kPa)	Output Voltage(V)
-3.75	0.5
0	2.5
3.75	4.5

#### SCHEMATIC DIAGRAM



## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		PXXXX TITLE
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS PART ERAS DTAL		1.MIL STATUS: ON/OFF 2.DTC STATUS: PRESENT/HISTORY 3.DIAG.STATUS: DIAGNOSIS FINISHED
		DTC CAUSE TO SYSTEM ERROR : PXXXX

### (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and Connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Ground Circuit Inspection" procedure.

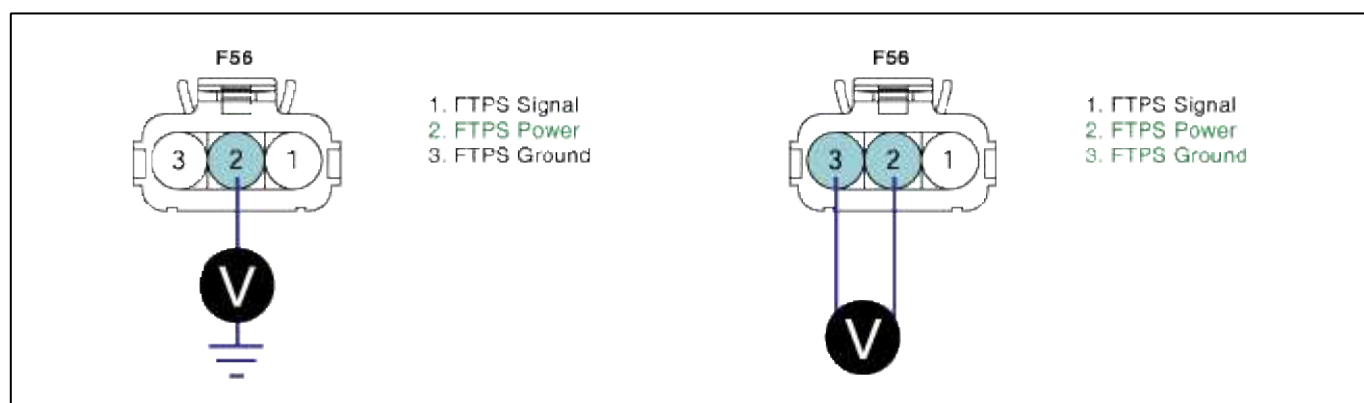
## GROUND CIRCUIT INSPECTION

1. IG "OFF" and disconnect FTPS connector and then turn the ignition ON.
2. Measure voltage between terminal 2 of FTPS harness connector and chassis ground.
3. Measure voltage between terminal 2 and 3 of FTPS harness connector.

---

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.

---



4. Is the measured voltage within specification ?

**YES**

Go to "Signal Circuit Inspection" procedure.

**NO**

Repair contact resistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

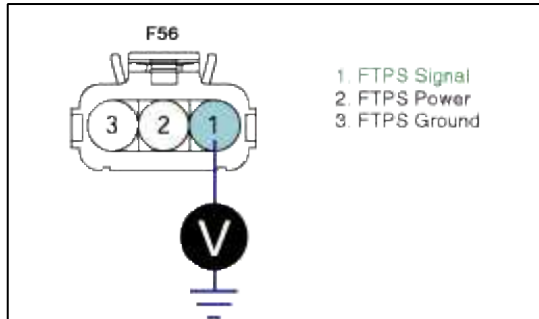
## SIGNAL CIRCUIT INSPECTION

1. Check voltage
  - (1) IG "OFF" and disconnect FTPS connector.
  - (2) IG "ON" & ENG "OFF"
  - (3) Measure voltage between terminal 1 of FTPS harness connector and chassis ground.

---

Specification : Approx. 0V

---



- (4) Is the measured voltage within specification ?

**YES**

Go to "Component Inspection" procedure.

**NO**

Go to "Check short to battery in harness" as follows.

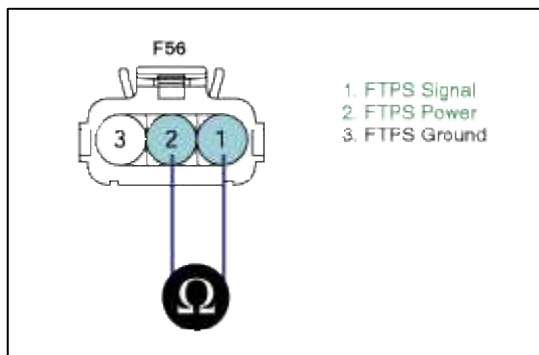
2. Check short to battery in harness

- (1) IG "OFF" and disconnect FTPS connector.
- (2) IG "ON" & ENG "OFF"
- (3) Measure resistance between terminals 2 and 1 of FTPS harness connector.

---

Specification : Infinite

---



- (4) Is the measured resistance within specification ?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check FTPS

(1) IG "OFF" and connect scantool to DLC(Data Link Connector).

(2) Monitor "FTPS" parameter on service data

**Specifcaton :**

Pressure(kPa)	Output Voltage(V)
-3.75	0.5
0	2.5
3.75	4.5

(3) Is the "FTPS" parameter on the service data O.K ?

**YES**

Go to "Check ECM" as follows.

**NO**

Substitute with a known - good FTPS and check for proper operation. If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

## 2. Check ECM

(1) IG "OFF" disconnect FTPS connector

(2) Connect Scantool and IG "ON" & ENG "OFF"

(3) Select simulation function on scantool.

(4) Simulate voltage at terminal 1 of FTPS harness connector.

1.5 SIMU-SCAN

MAF	5.6	g/s
MAP	4.9	psi
ETC SYSTEM VALUE	6.8	%
TANK PRESS SNSR	1.2	

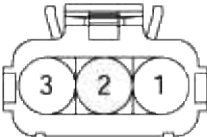
SIMULATION OF VOLTAGE

3.64 V

( CH B ONLY )

METR
SIML
CLR
FIX

F56



1. FTPS Signal

2. FTPS Power

3. FTPS Ground

(5) Does the signal value of FTP sensor change according to simulation voltage ?

**YES**

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorated damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace and go to "Verification of Vehicle Repair" procedure.

## NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. Before or after testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

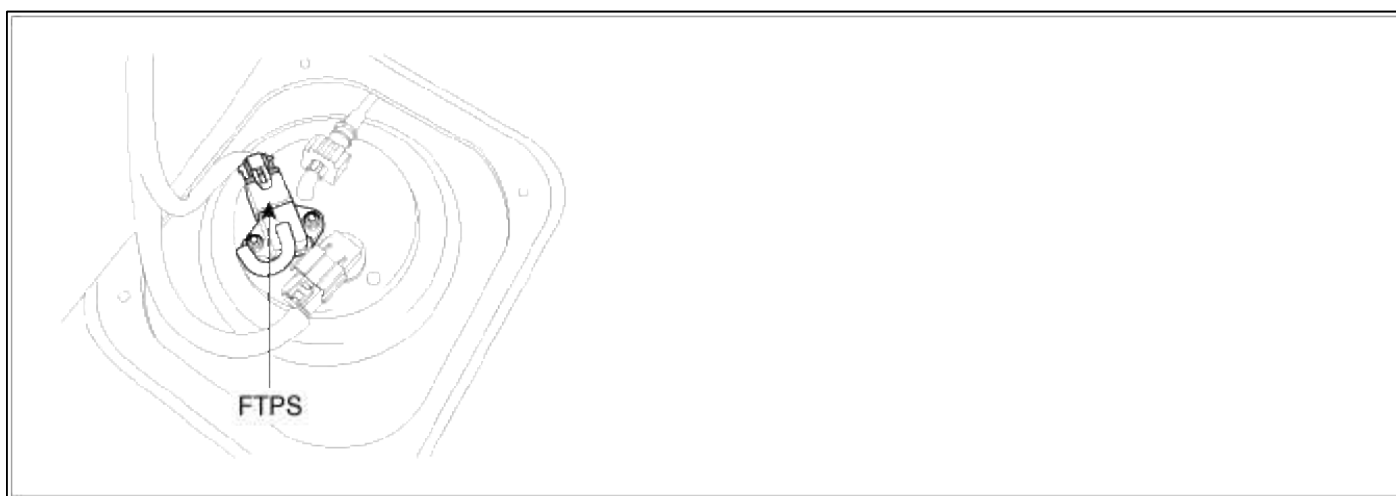
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

### Emission Control System > Troubleshooting > P0454

#### COMPONENT LOCATION



#### GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

#### DTC DESCRIPTION

Checking output signals from FTPS under detecting condition, if the FTPS indicates pressure momentarily increased more than 5.6 reading displaying on scantool, ECM sets P0454. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

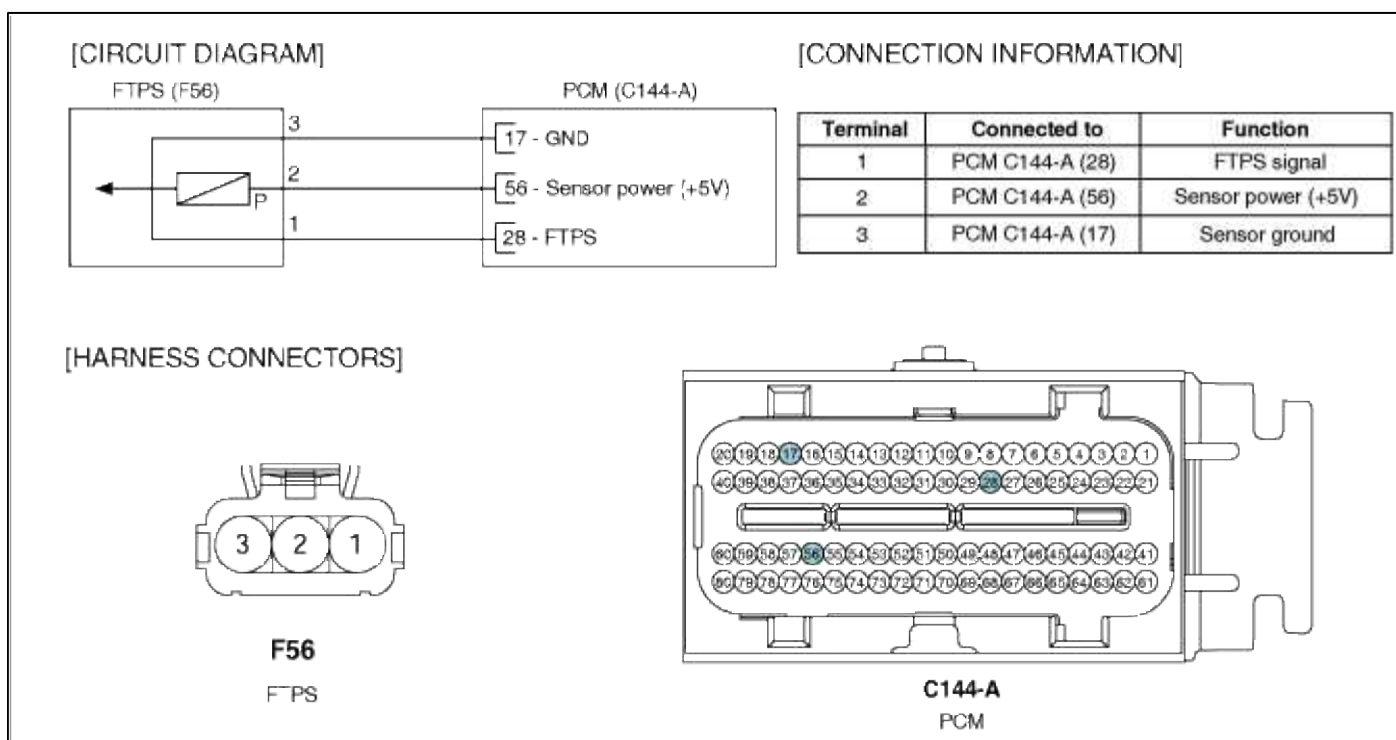
#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Monitors the fuel tank pressure</li> </ul>	<ul style="list-style-type: none"> <li>Poor Connection</li> <li>Faulty FTPS</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>Engine Running</li> <li>Intake Air Temperature <math>\geq -4^{\circ}\text{C}</math> (24.8 <math>^{\circ}\text{F}</math>)</li> <li>No Faults Present</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Tank Pressure <math>&gt; 5.6</math> reading displaying on scantool</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>Continuous (Within 10 sec.)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## SPECIFICATION

Pressure(kPa)	Output Voltage(V)
-3.75	0.5
0	2.5
3.75	4.5

## SCHEMATIC DIAGRAM



## MONITOR DTC STATUS



## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

- (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and Connector Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to " Component Inspection " procedure

## COMPONENT INSPECTION

## 1. Check FTPS

(1) IG "OFF" and connect scantool to DLC(Data Link Connector).

(2) Monitor "FTPS" parameter with acceleration on service data

**Specifcaton :**

Pressure(kPa)	Output Voltage(V)
-3.75	0.5
0	2.5
3.75	4.5

(3) Does the FTPS change while racing the accelerator pedal at idle ?

**YES**

Fault is intermittent. Drive the vehicle to satisfy the enable condition then, go to "Verification of Vehicle Repair " procedure.

**NO**

Substitute with a known - good FTPS and check for proper operation. If the problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

**VERIFICATION OF VEHICLE REPAIR**

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

**Emission Control System > Troubleshooting > P0455****GENERAL DESCRIPTION**

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor flow from the canister to the intake manifold.

**DTC DESCRIPTION**

Checking output signals from fuel tank pressure sensor under evap.system test, if fuel tank's vacuum is lower than prescribed threshold in ECM, ECM sets P0455 and then MIL(Malfunction Indication Lamp) turns on.

**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Monitor the fuel tank's vacuum</li> </ul>	<ul style="list-style-type: none"> <li>• Fuel Filler Cap missing</li> <li>• Leakage in each hose/fuel filler pipe</li> <li>• Leakage in CCV/ Canister/ Fuel tank</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• 10 V &lt; Battery voltage &lt; 16 V</li> <li>• Barometric pressure &gt; 72 kPa (0.72 bar)</li> <li>• Engine coolant temperature at startup - Intake air temperature at startup &lt; 6.7°C(12 °F)</li> <li>• Engine coolant temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>• Intake air temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>• Fuel level: 15 ~ 85 %</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Fuel tank's vacuum &lt; a prescribed threshold in ECM</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>• One time during Evaporative system diagnosis</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 1 Driving cycle</li> </ul>	

## MONITOR SCANTOOL DATA

### 1. Check DTC Status

(1) Connect scantool to Data Link Connector(DLC).

(2) IG "ON".

(3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu

(4) Read "DTC Status" parameter.

<p><b>1.1 DIAGNOSTIC TROUBLE CODES</b></p> <p><b>PXXXX DTC TITLE</b></p>          <p><b>NUMBER OF DTC : 1 ITEMS</b></p> <p><b>PART ERAS DTAL</b></p>	<p><b>PXXXX TITLE</b></p>          <p><b>1.MIL STATUS: ON/OFF</b></p> <p><b>2.DTC STATUS: PRESENT/HISTORY</b></p> <p><b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b></p>          <p><b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b></p>
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(5) Is "Present" Fault displayed?

**YES**

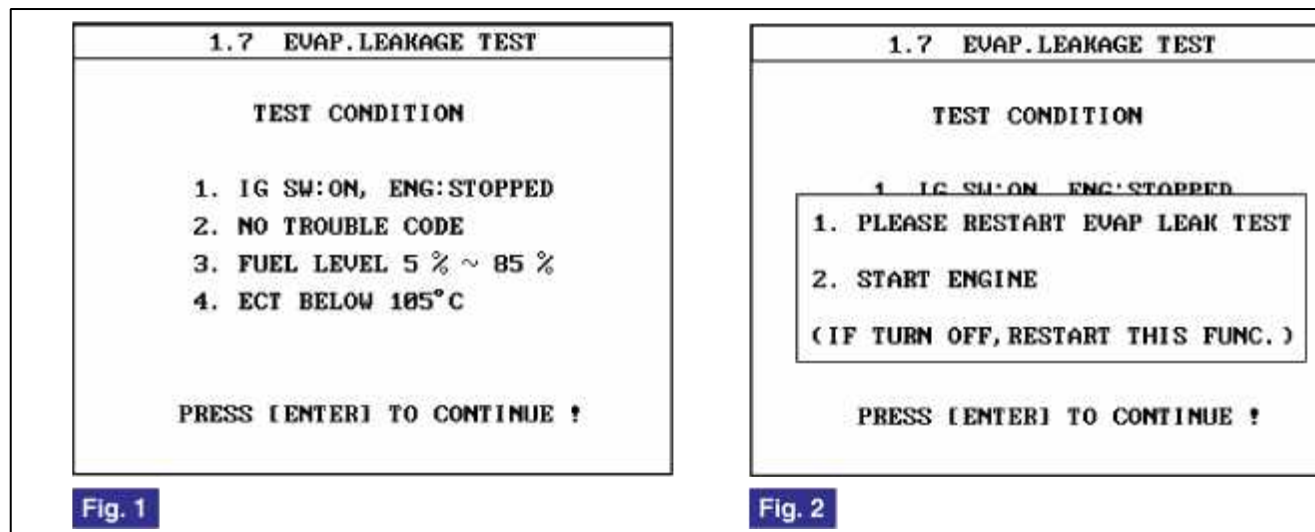
Check the Fuel Filler Cap is installed. If not, after closing it, go to "Evap.Leakage Test" as indicated below with scan tool.

**NO**

Go to "Evap.Leakage Test" as indicated below with scan tool.

## 2. Evap. Leakage Test

- (1) Cool the vehicle down for about two hours to prevent misdiagnosis.
- (2) Install scan tool and IG "ON" and then clear DTC.
- (3) Select and press "EVAP.LEAKAGE TEST" mode in the scan tool.
- (4) Check if the vehicle is under test conditions as indicated below [Fig 1].
- (5) If OK, Start engine and restart Evap.Leakage Test again[Fig 2].



- (6) Is the same DTC set after the Evap.leakage test with scan tool ?

**YES**

Go to "System Inspection" procedure.

**NO**

Fault is intermittent caused by the fuel cap missing and go to "Verification of vehicle Repair" procedure.

## SYSTEM INSPECTION

### 1. Check Fuel Filler Cap

- (1) Check the Fuel Filler Cap is installed and properly tightened.
- (2) Check if the Fuel Filler Cap seal is missing or damaged.
- (3) Is the Fuel Filler Cap OK?

**YES**

Go to "Check vapor hoses for leakage in fuel system" as indicated below

**NO**

Replace the Fuel Filler Cap and go to "Verification of Vehicle Repair" procedure.

### 2. Check vapor hoses for leakage in fuel system

- (1) Check vapor hoses between the following components for leakage:
  - A. Intake manifold ~ Purge control solenoid valve (PCSV)
  - B. Purge control solenoid valve (PCSV) ~ Canister
  - C. Canister ~ Canister close valve (CCV)
  - D. Canister ~ fuel tank

- (2) Does a leak exist?

**YES**

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check fuel filler pipe for crack or leakage" as indicated below

3. Check fuel filler pipe for crack or leakage
  - (1) Check that there is crack or leakage in fuel filler pipe
  - (2) Is there any crack or leakage ?

**YES**

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Component inspection" procedure.

## COMPONENT INSPECTION

1. Check CCV for leakage
  - (1) Disconnect the hose leading from the CCV to Canister at CCV.
  - (2) Visually Check any tear of the hose leading from the CCV to Canister
  - (3) When the CCV operates, apply a vacuum at the nipple and verify that the CCV holds vacuum.
  - (4) Does a leak exist?

**YES**

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check Canister for leakage" as indicated below

2. Check Canister for leakage
  - (1) Disconnect the hose leading from the CCV to Canister at Canister.
  - (2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum.
  - (3) Does a leak exist?

**YES**

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check fuel tank for leakage" as indicated below

3. Check fuel tank for leakage
  - (1) Check fuel tank for crack or leakage.
  - (2) Does a leak exist?

**YES**

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Carefully perform this troubleshooting procedure all over again from the beginning.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter

## 4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

### Emission Control System > Troubleshooting > P0456

#### GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor flow from the canister to the intake manifold.

#### DTC DESCRIPTION

Checking output signals from fuel tank pressure sensor under evap.system test, if fuel tank's vacuum decay slope is higher than prescribed threshold in ECM, ECM sets P0456 and then MIL(Malfunction Indication Lamp) turns on.

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Monitor the vacuum decay slope</li> </ul>	<ul style="list-style-type: none"> <li>Leakage in each hose/fuel filler pipe</li> <li>Leakage in CCV/ Canister/ Fuel tank /Fuel Filler Cap</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>10 V &lt; Battery voltage &lt; 16 V</li> <li>Barometric pressure &gt; 72 kPa (0.72 bar)</li> <li>Engine coolant temperature at startup - Intake air temperature at startup &lt; 6.7°C(12 °F)</li> <li>Engine coolant temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>Intake air temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>Fuel level: 15 ~ 85 %</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>The vacuum decay slope &gt; a prescribed threshold in ECM</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>One time during Evaporative system diagnosis</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>1 Driving cycle</li> </ul>	

#### MONITOR SCANTOOL DATA

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">       </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b>  <b>2.DTC STATUS: PRESENT/HISTORY</b>  <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
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- (5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Go to "Evap.Leakage Test" as indicated below with scan tool.

## 2. Evap. Leakage Test

- (1) Cool the vehicle down for about two hours to prevent misdiagnosis.
- (2) Install scan tool and IG "ON" and then clear DTC.
- (3) Select and press "EVAP.LEAKAGE TEST" mode in the scan tool.
- (4) Check if the vehicle is under test conditions as indicated below [Fig 1].
- (5) If OK, Start engine and restart Evap.Leakage Test again[Fig 2].

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.7 EVAP.LEAKAGE TEST</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>TEST CONDITION</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1. IG SW:ON, ENG:STOPPED</b>  <b>2. NO TROUBLE CODE</b>  <b>3. FUEL LEVEL 5 % ~ 85 %</b>  <b>4. ECT BELOW 105°C</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>PRESS [ENTER] TO CONTINUE !</b> </div> <div style="background-color: #000080; color: white; text-align: center; padding: 2px; margin-top: 5px;"> <b>Fig. 1</b> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.7 EVAP.LEAKAGE TEST</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>TEST CONDITION</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1. IG SW:ON, ENG:STOPPED</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1. PLEASE RESTART EVAP LEAK TEST</b>  <b>2. START ENGINE</b>  <b>( IF TURN OFF, RESTART THIS FUNC. )</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>PRESS [ENTER] TO CONTINUE !</b> </div> <div style="background-color: #000080; color: white; text-align: center; padding: 2px; margin-top: 5px;"> <b>Fig. 2</b> </div>
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(6) Is the same DTC set after the Evap.leakage test with scan tool ?

**YES**

Go to "System Inspection" procedure.

**NO**

Repeat "Evap.leakage test" with scan tool after cool the vehicle down sufficiently. If the same DTC isn't disp after the test, it was intermittent fault. Go to "Verification of vehicle Repair" procedure.

## SYSTEM INSPECTION

### 1. Check Fuel Filler Cap

(1) Check the Fuel Filler Cap is installed and properly tightened.

(2) Check if the Fuel Filler Cap seal is missing or damaged.

(3) Is the Fuel Filler Cap OK?

**YES**

Go to "Check vapor hoses for leakage in fuel system" as indicated below

**NO**

Replace the Fuel Filler Cap and go to "Verification of Vehicle Repair" procedure.

### 2. Check vapor hoses for leakage in fuel system

(1) Check vapor hoses between the following components for leakage:

A. Intake manifold ~ Purge control solenoid valve (PCSV)

B. Purge control solenoid valve (PCSV) ~ Canister

C. Canister ~ Canister close valve (CCV)

D. Canister ~ fuel tank

(2) Does a leak exist?

**YES**

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check fuel filler pipe for crack or leakage" as indicated below

### 3. Check fuel filler pipe for crack or leakage

(1) Check that there is crack or leakage in fuel filler pipe

(2) Is there any crack or leakage ?

**YES**

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Component inspection" procedure.

## COMPONENT INSPECTION



## 1. Check CCV for leakage

- (1) Disconnect the hose leading from the CCV to Canister at CCV.
- (2) Visually Check any tear of the hose leading from the CCV to Canister
- (3) When the CCV operates, apply a vacuum at the nipple and verify that the CCV holds vacuum.
- (4) Does a leak exist?

**YES**

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check Canister for leakage" as indicated below

## 2. Check Canister for leakage

- (1) Disconnect the hose leading from the CCV to Canister at Canister.
- (2) When the other nipples are plugged, apply a vacuum at the vent nipple and verify that the Canister holds vacuum.
- (3) Does a leak exist?

**YES**

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check fuel tank for leakage" as indicated below

## 3. Check fuel tank for leakage

- (1) Check fuel tank for crack or leakage.
- (2) Does a leak exist?

**YES**

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Carefully perform this troubleshooting procedure all over again from the beginning.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

**Emission Control System > Troubleshooting > P2422**

## GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The PCM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the PCM and controls fuel vapor flow from the canister to the intake manifold.

## DTC DESCRIPTION

Checking output signals from fuel tank pressure sensor at purging, if fuel tank's vacuum is higher than prescribed threshold in ECM, ECM sets P2422.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Monitor the fuel tank's vacuum</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Canister Close Valve</li> <li>Clogging of canister air filter</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>10 V &lt; Battery voltage &lt; 16 V</li> <li>Barometric pressure &gt; 72 kPa (0.72 bar)</li> <li>Engine coolant temperature at startup - Intake air temperature at startup &lt; 6.7°C(12 °F)</li> <li>Engine coolant temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>Intake air temperature at startup: 4.5 ~ 35°C(40 ~ 95 °F)</li> <li>Fuel level: 15 ~ 85 %</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Fuel tank's vacuum at purging &gt; a prescribed threshold in ECM</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>2 Driving Cycles</li> </ul>	

## MONITOR DTC STATUS

## 1. Check DTC Status

(1) Connect scantool to Data Link Connector(DLC).

(2) IG "ON".

(3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu

(4) Read "DTC Status" parameter.

<b>1.1 DIAGNOSTIC TROUBLE CODES</b> <hr/> <b>PXXXX DTC TITLE</b> <hr/>          <hr/> <b>NUMBER OF DTC : 1 ITEMS</b> <hr/> <table border="1"> <tr> <td>PART</td> <td>ERAS</td> <td>DTAL</td> </tr> </table>		PART	ERAS	DTAL	<b>PXXXX TITLE</b> <hr/> <b>1.MIL STATUS: ON/OFF</b> <b>2.DTC STATUS: PRESENT/HISTORY</b> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b>    <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b>
PART	ERAS	DTAL			

(5) Is "Present" Fault displayed?

**YES**

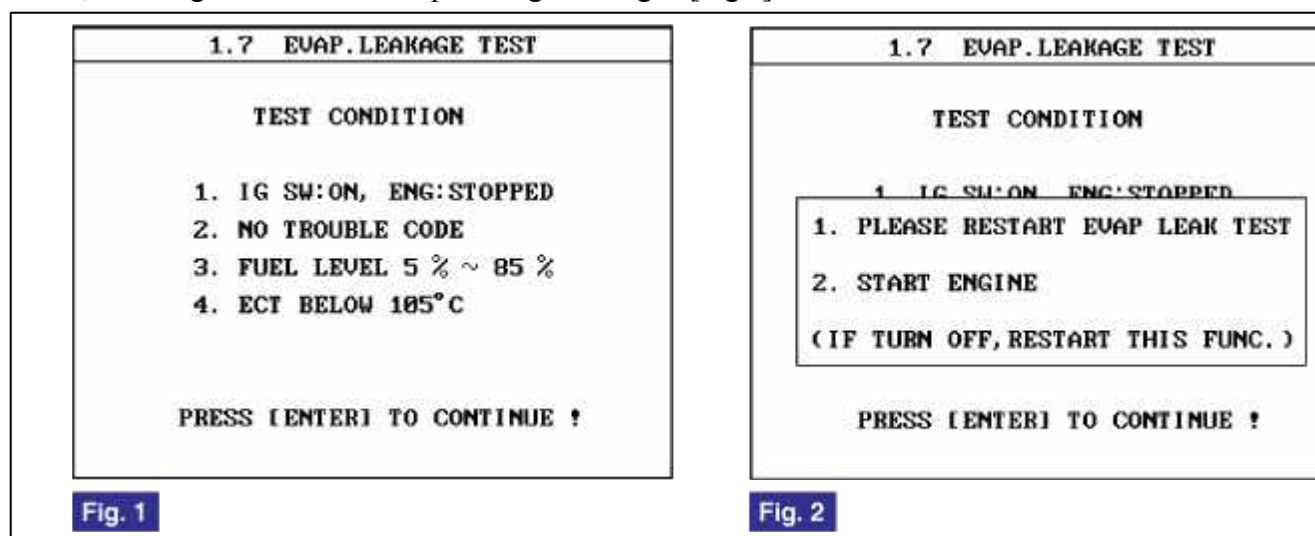
Go to "Component Inspection" procedure.

**NO**

Go to "Evap.Leakage Test" as indicated below with scan tool.

## 2. Evap. Leakage Test

- (1) Cool the vehicle down for about two hours to prevent misdiagnosis.
- (2) Install scan tool and IG "ON" and then clear DTC.
- (3) Select and press "EVAP.LEAKAGE TEST" mode in the scan tool.
- (4) Check if the vehicle is under test conditions as indicated below [Fig 1].
- (5) If OK, Start engine and restart Evap.Leakage Test again[Fig 2].



Is the same DTC set after the Evap.leakage test with scan tool ?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repeat "Evap.leakage test" with scan tool after cool the vehicle down sufficiently. If the same DTC isn't display after the test, it was intermittent fault. Go to "Verification of vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. Check Canister air filter and CCV

- (1) Check air filter clogging condition.
- (2) Check duck between air filter and CCV for clogging condition.
- (3) Check that Canister is deformed or clogged by foreign materials.
- (4) Has a problem been found ?

**YES**

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

**NO**

Carefully perform this troubleshooting procedure all over again from the beginning.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

### 1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode

2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

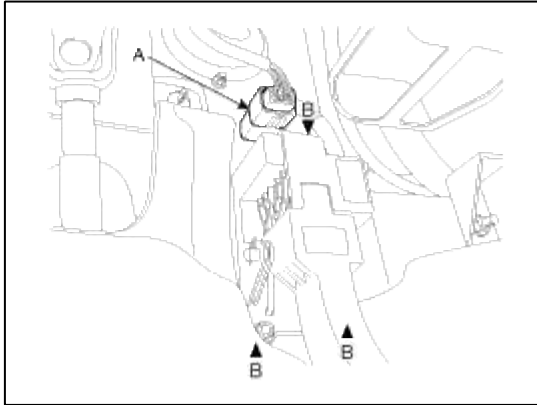
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****REMOVAL**

1. Turn ignition switch off and disconnect the battery (-) cable from the battery.
2. Disconnect the accelerator position sensor connector (A).



3. Unfasten the mounting bolt/nuts (B) and remove the accelerator pedal from the vehicle.

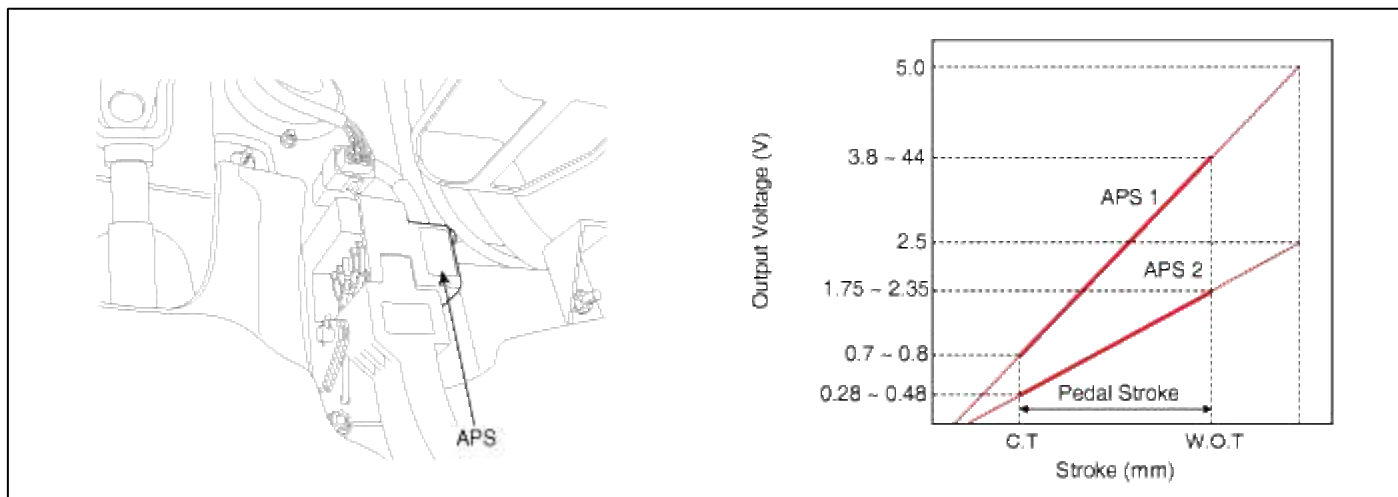
**INSTALLATION**

1. Install the accelerator pedal in according to the reverse order of "REMOVAL" procedure.

---

Accelerator pedal mounting nuts: 7.8 ~ 11.8N·m (0.8 ~ 1.2kgf·m, 5.8 ~ 8.7lbf·ft)

---

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System**
**INSPECTION**
**FUNCTION AND OPERATION PRINCIPLE**


Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that it is abnormal.

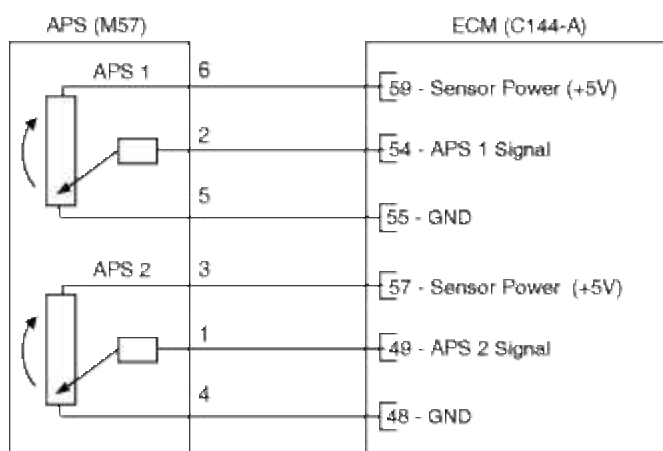
**SPECIFICATION**

Pedal Position	Output Voltage (V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8	0.28 ~ 0.48
W.O.T	3.8 ~ 4.4	1.75 ~ 2.35

Item	Sensor Resistance
APS1	0.7 ~ 1.3k $\Omega$ at 20°C (68°F)
APS2	1.4 ~ 2.6k $\Omega$ at 20°C (68°F)

**SCHEMATIC DIAGRAM**

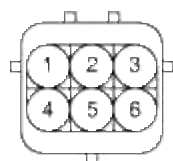
## [CIRCUIT DIAGRAM]



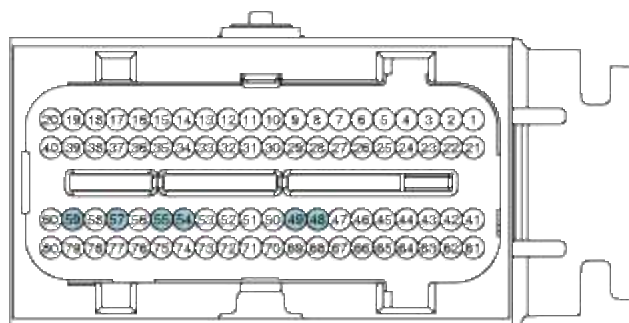
## [CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C144-A (49)	APS 2 Signal
2	ECM C144-A (54)	APS 1 Signal
3	ECM C144-A (57)	APS 2 Sensor Power (+5V)
4	ECM C144-A (48)	APS 2 Ground
5	ECM C144-A (55)	APS 1 Ground
6	ECM C144-A (59)	APS 1 Sensor Power (+5V)

## [HARNESS CONNECTORS]



**M57**  
APS



**C144-A**  
ECM

## COMPONENT INSPECTION

1. Connect a scan tool to the Diagnosis Link Connector (DLC).
2. Start engine and check output voltages of APS 1 and 2 at C.T and W.O.T.

Specification: Refer to SPECIFICATION.

3. Turn ignition switch OFF and disconnect the scantool from the DLC.
4. Disconnect APS connector and measure resistance between APS terminals 5 and 6 (APS 1).

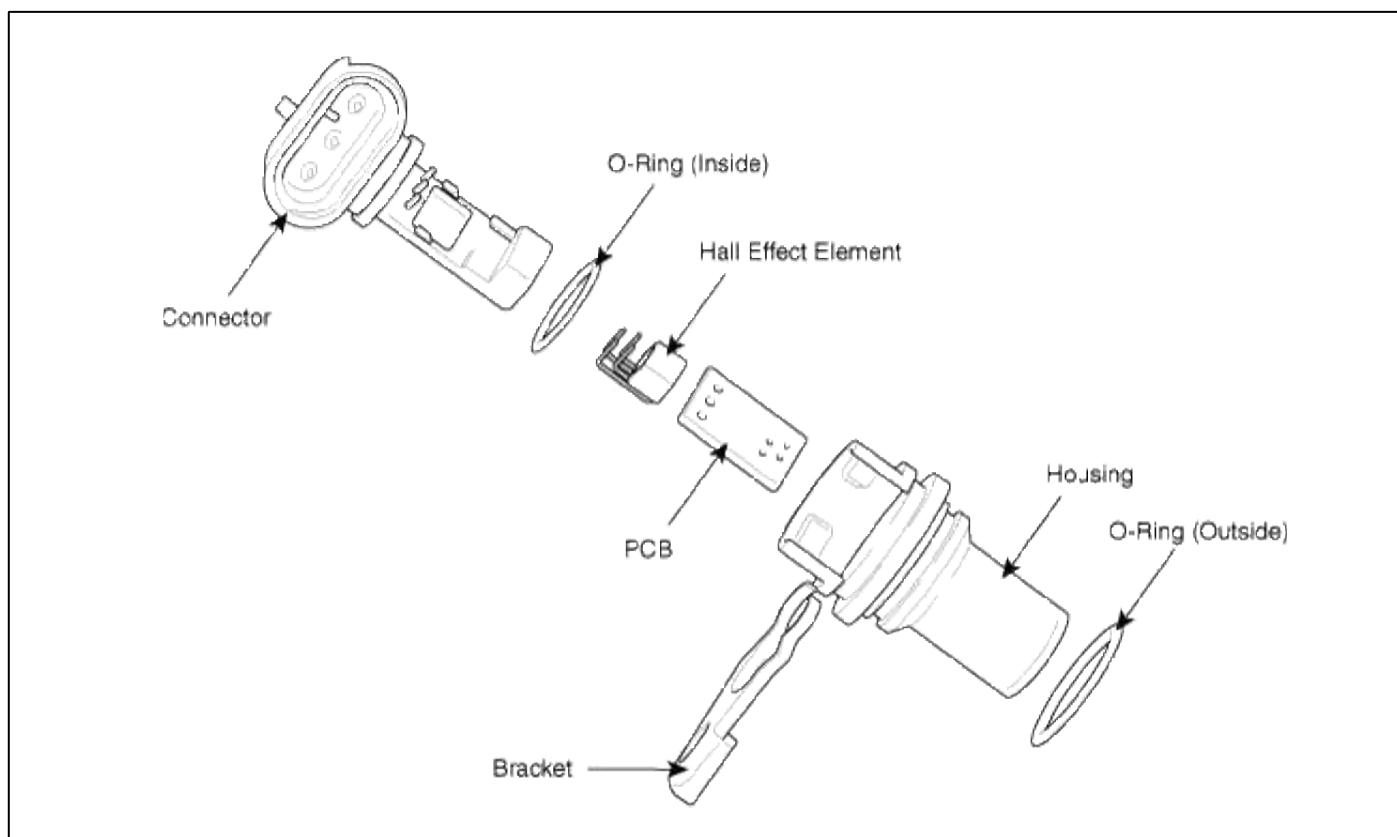
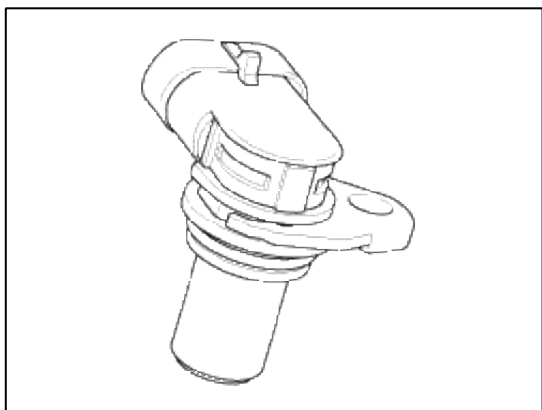
Specification: Refer to SPECIFICATION.

5. Disconnect APS connector and measure resistance between APS terminals 3 and 4 (APS 2).

Specification: Refer to SPECIFICATION.

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

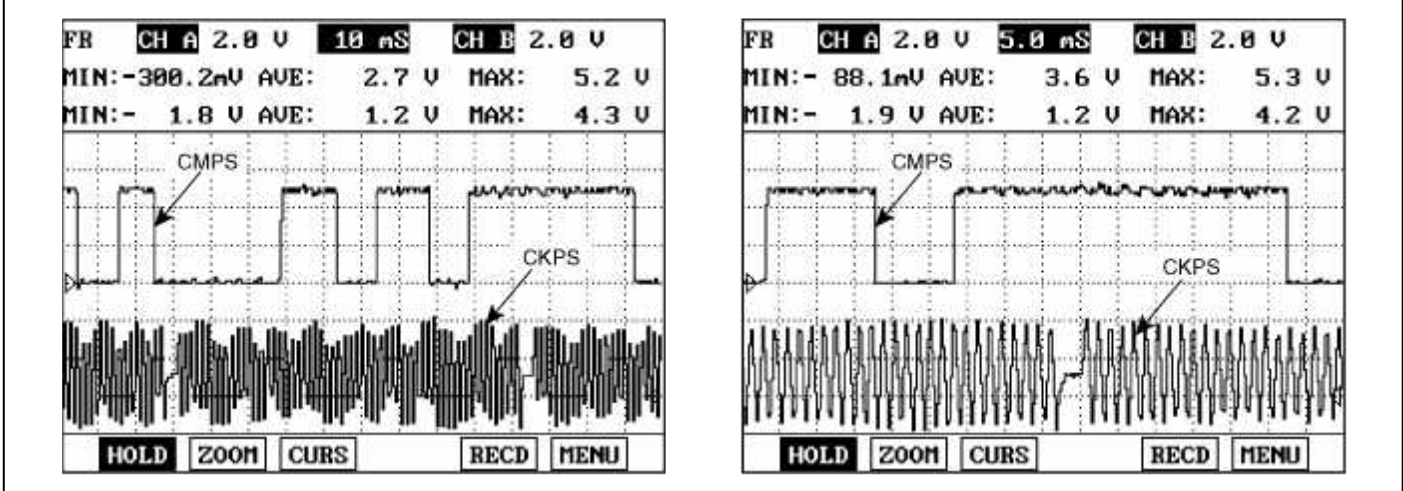
Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. So the sequential injection of the 6 cylinders is impossible without CMPS signal.

**SPECIFICATION**

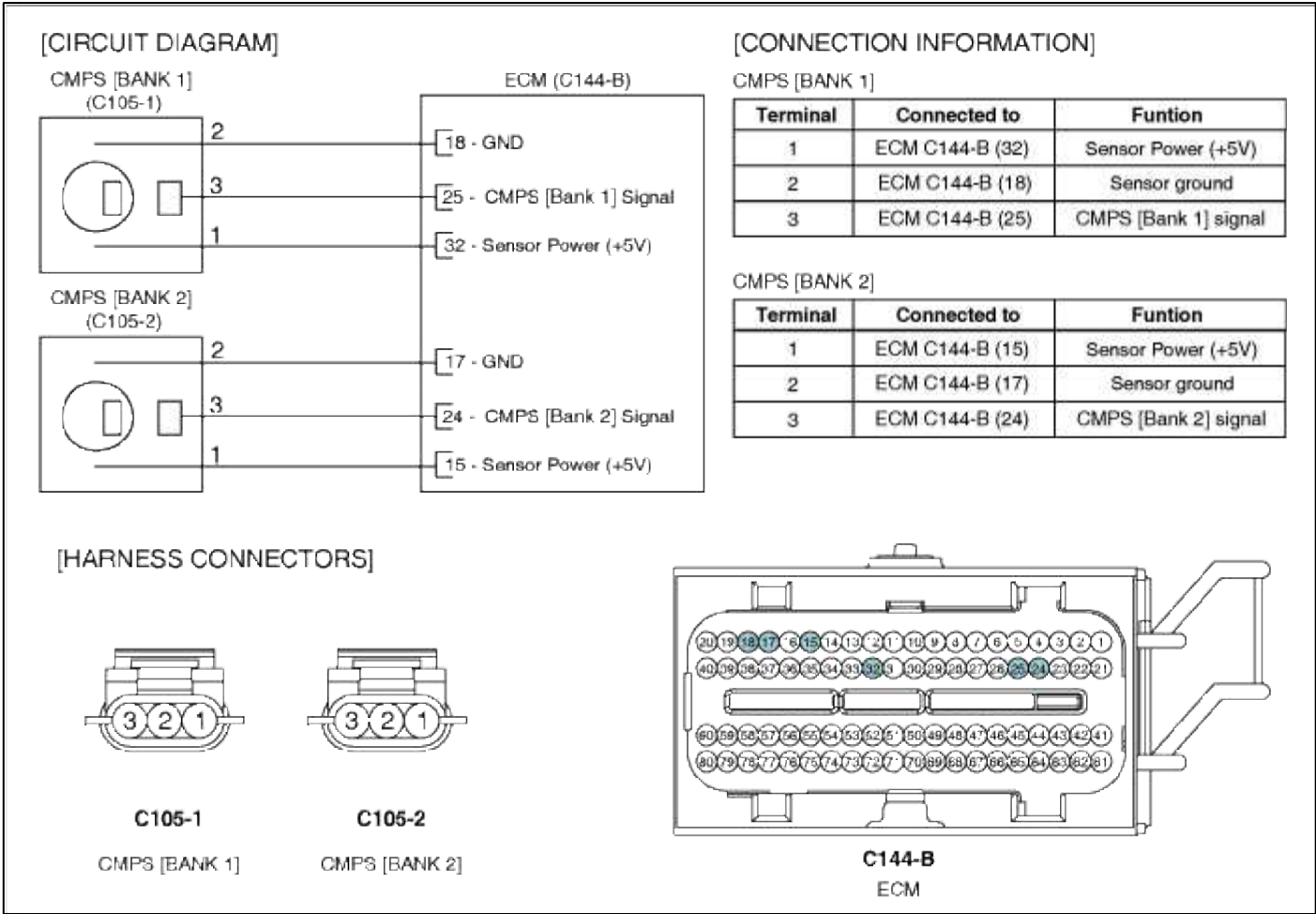
Item	Specification
Output Voltage (V)	High : 5.0V
	Low : 0 ~ 0.7V
Air Gap (mm)	0.5 ~ 1.5

**WAVEFORM**





SCHEMATIC DIAGRAM

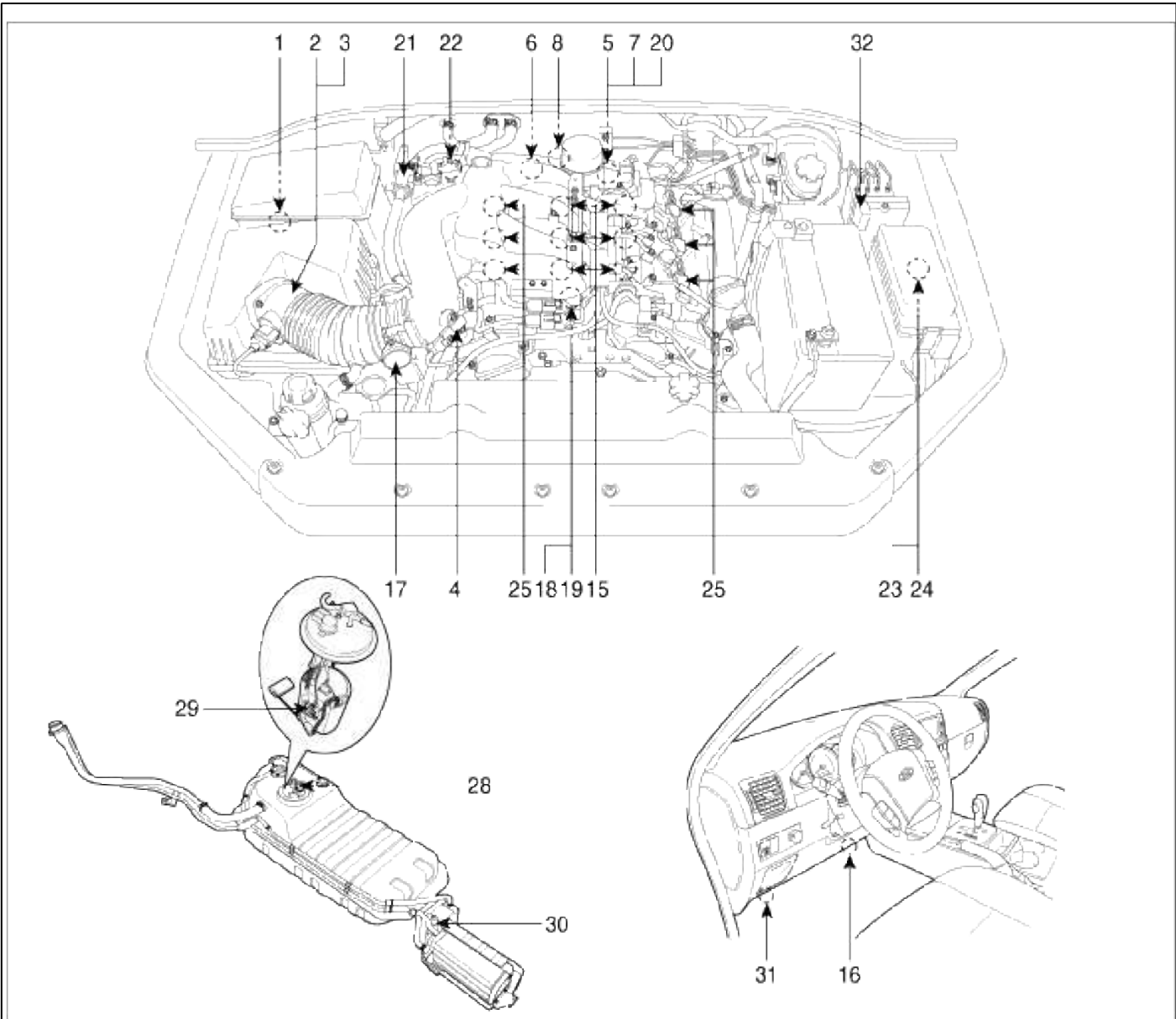


COMPONENT INSPECTION

1. Check signal waveform of CMPS and CKPS using a scantool.

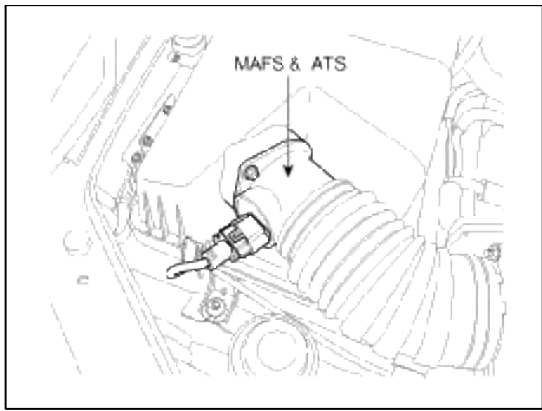
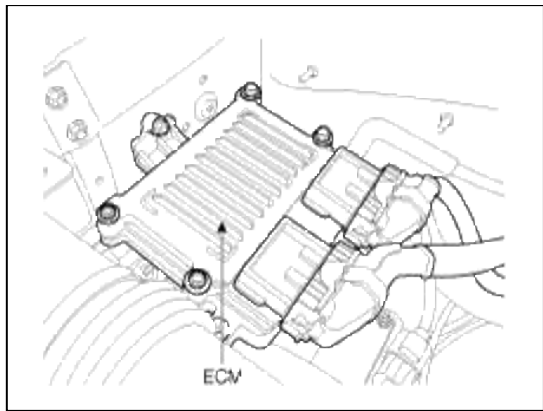
Specification: Refer to "WAVE FORM"

COMPONENT LOCATION



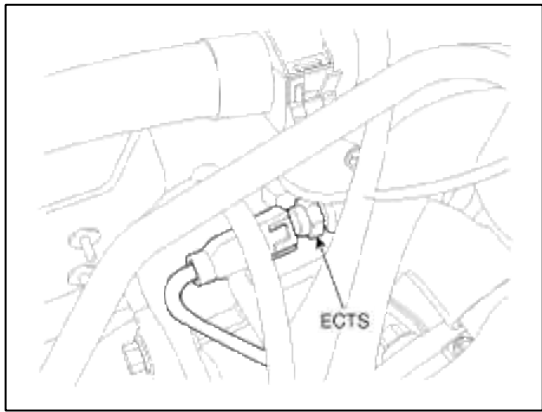
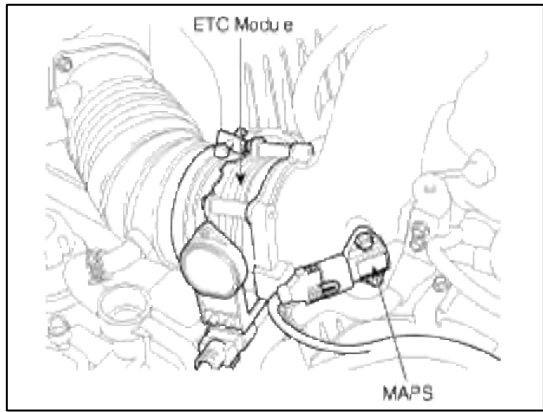
- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>1. ECM (Engine Control Module)</li><li>2. Mass Air Flow Sensor (MAFS)</li><li>3. Intake Air Temperature Sensor (IATS)</li><li>4. Manifold Absolute Pressure Sensor (MAPS)</li><li>5. Engine Coolant Temperature Sensor (ECTS)</li><li>6. Camshaft Position Sensor (CMPS) [Bank 1]</li><li>7. Camshaft Position Sensor (CMPS) [Bank 2]</li><li>8. Crankshaft Position Sensor (CKPS)</li><li>9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]</li><li>10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]</li><li>11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]</li><li>12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]</li><li>13. Knock Sensor (KS) [Bank 1]</li><li>14. Knock Sensor (KS) [Bank 2]</li><li>15. Injector</li><li>16. Accelerator Position Sensor (APS)</li></ul> | <ul style="list-style-type: none"><li>17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]</li><li>18. CVVT Oil Control Valve (OCV) [Bank 1]</li><li>19. CVVT Oil Control Valve (OCV) [Bank 2]</li><li>20. CVVT Oil Temperature Sensor (OTS)</li><li>21. Purge Control Solenoid Valve (PCSV)</li><li>22. Variable Intake Solenoid (VIS) Valve</li><li>23. Fuel Pump Relay</li><li>24. Main Relay</li><li>25. Ignition Coil</li><li>26. A/C Pressure Transducer (APT)</li><li>27. Wheel Speed Sensor (WSS)</li><li>28. Fuel Tank Pressure Sensor (FTPS)</li><li>29. Fuel Level Sensor (FLS)</li><li>30. Canister Close Valve (CCV)</li><li>31. Data Link Connector (DLC)</li><li>32. Multi-Purpose Check Connector</li></ul> |
|--|--|

1. ECM (Engine Control Module)	2. Mass Air Flow Sensor (MAFS)
	3. Intake Air Temperature Sensor (IATS)



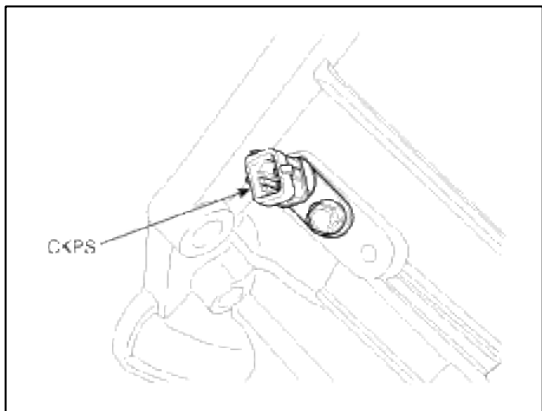
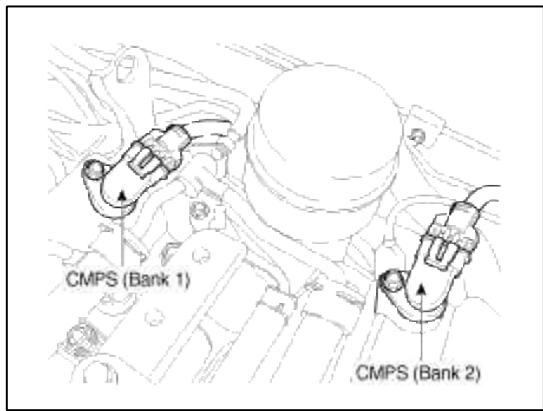
4. Manifold Absolute Pressure Sensor (MAPS)  
17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]

5. Engine Coolant Temperature Sensor (ECTS)



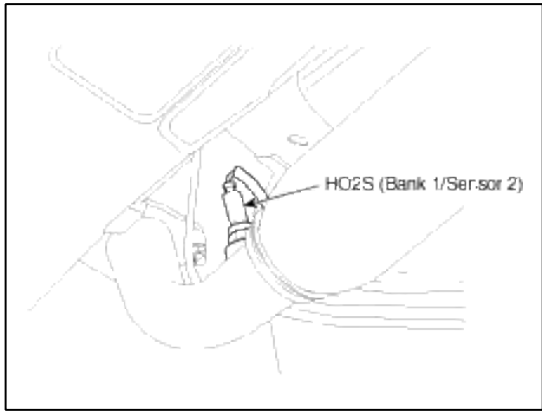
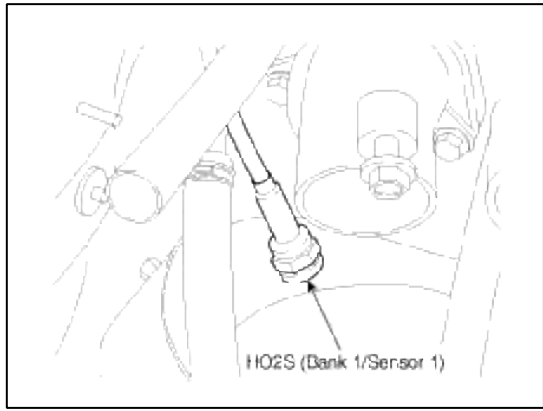
6. Camshaft Position Sensor (CMPS) [Bank 1]  
7. Camshaft Position Sensor (CMPS) [Bank 2]

8. Crankshaft Position Sensor (CKPS)



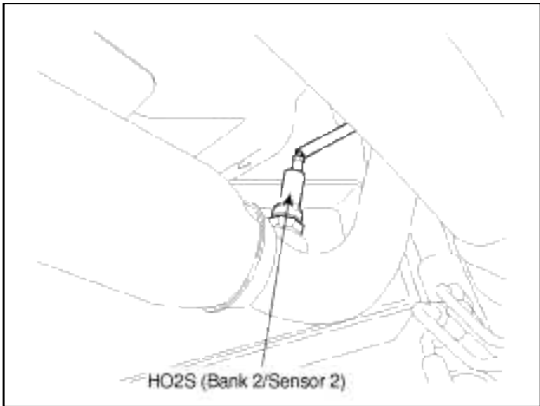
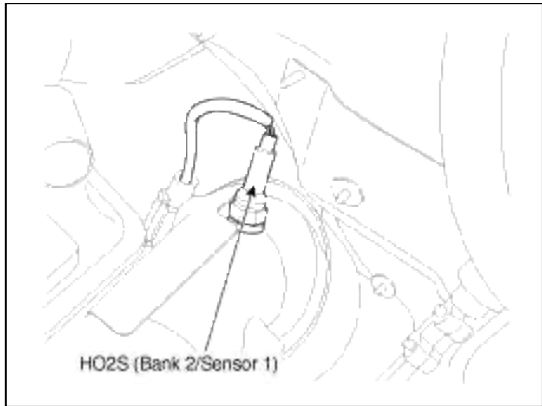
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]

10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]



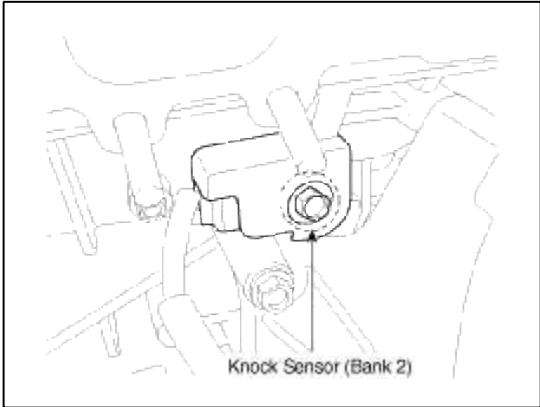
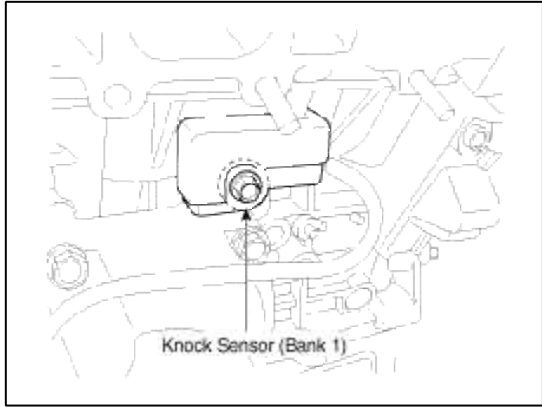
11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]

12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]

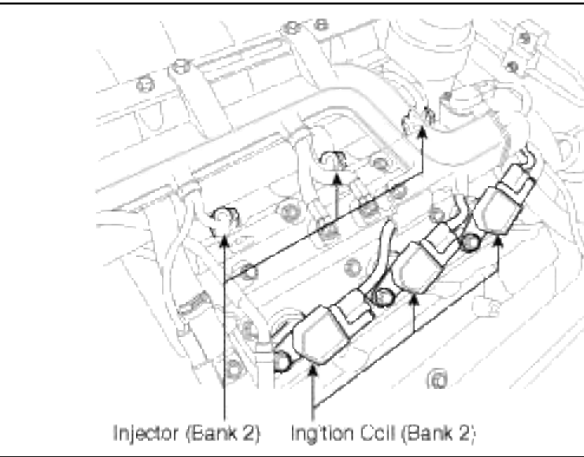
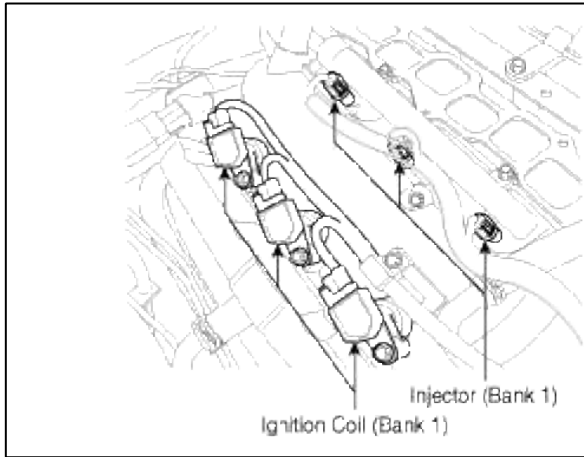


13. Knock Sensor (KS) [Bank1]

14. Knock Sensor [Bank 2]

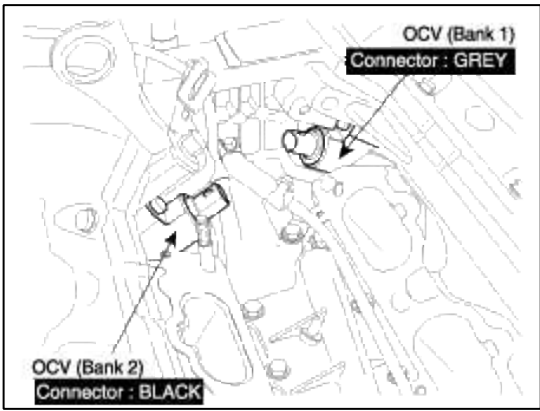
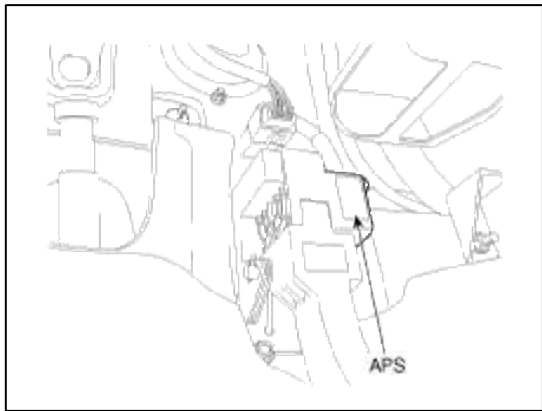


15. Injector  
25. Ignition Coil



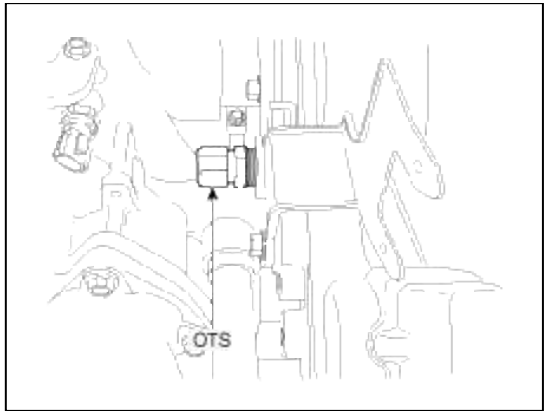
16. Accelerator Position Sensor (APS)

18. CVVT Oil Control Valve (OCV) [Bank 1]  
19. CVVT Oil Control Valve (OCV) [Bank 2]

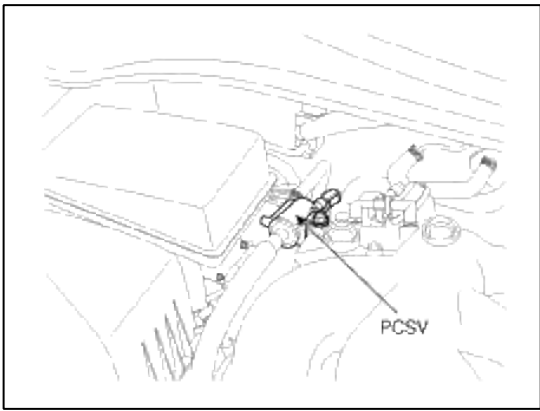


20. CVVT Oil Temperature Sensor (OTS)

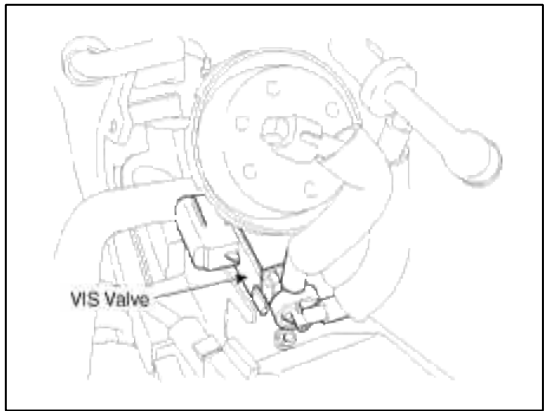
21. Purge Control Solenoid Valve (PCSV)



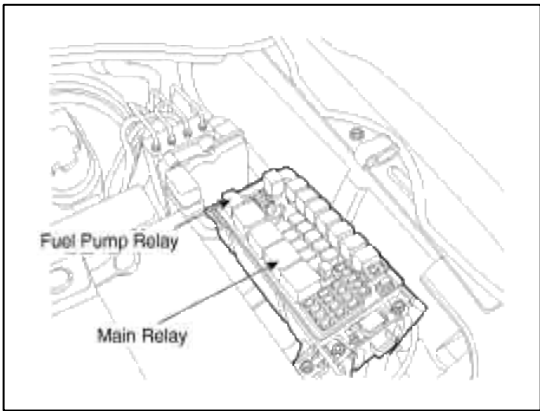
22. Variable Intake Solenoid (VIS) Valve



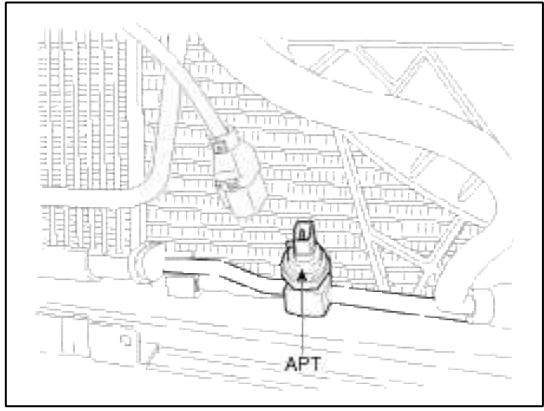
23. Fuel Pump Relay  
24. Main Relay



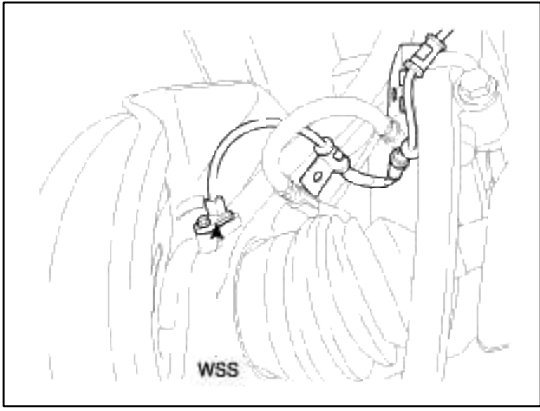
26. A/C Pressure Transducer (APT)



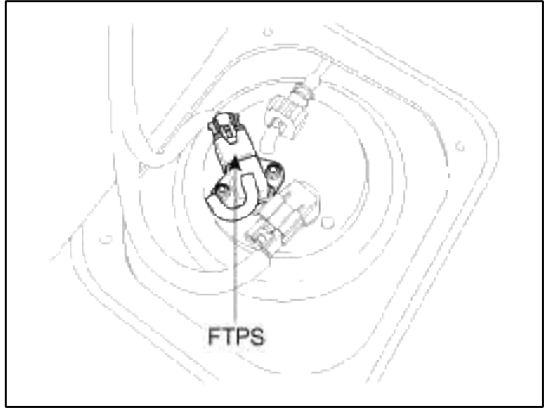
27. Wheel Speed Sensor (WSS)



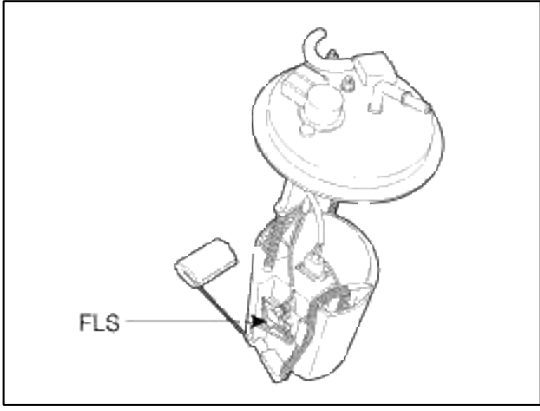
28. Fuel Tank Pressure Sensor (FTPS)

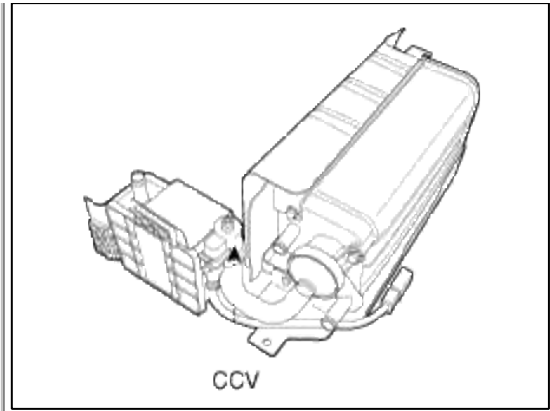


30. Fuel Level Sensor (FLS)



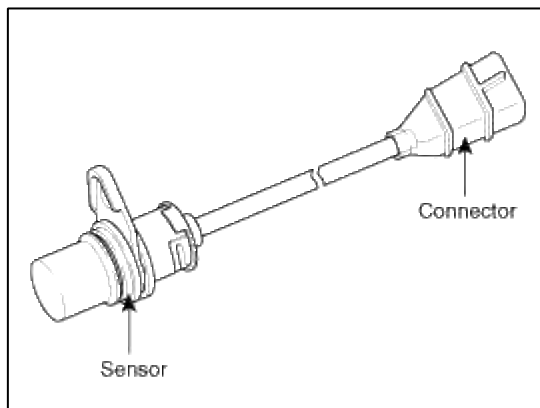
31. Cansister Close Valve (CCV)





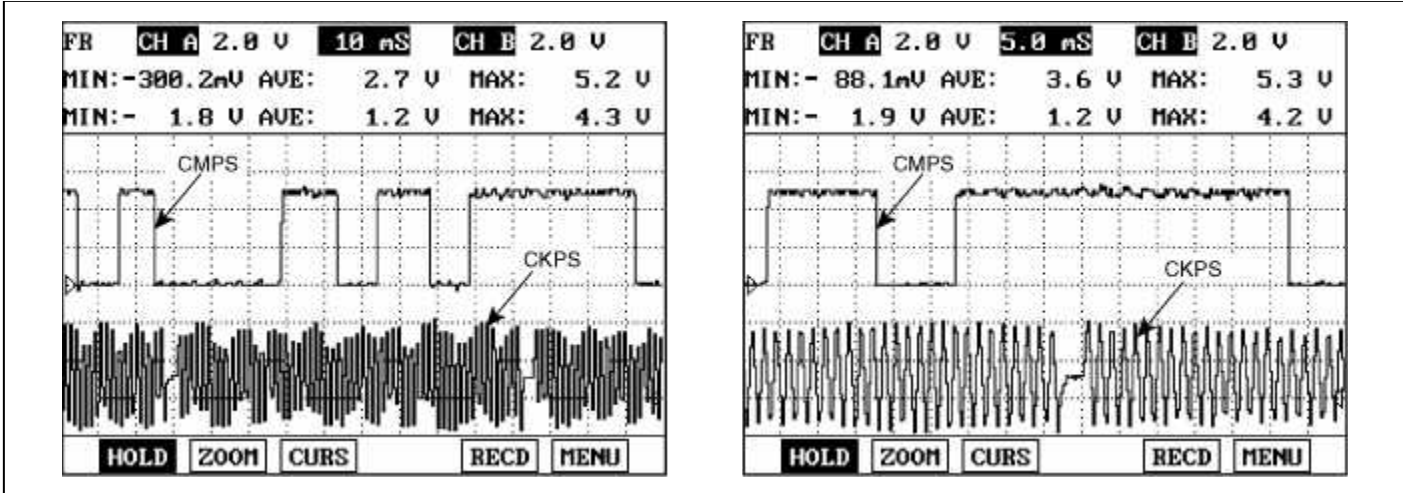
**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, fuel is not supplied and the main relay does not operate. That is, vehicle can't run without CKPS signal. This sensor is installed on transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when the engine rotates. The target wheel consists of 58 slots and 2 missing slots on 360 CA (Crank Angle).

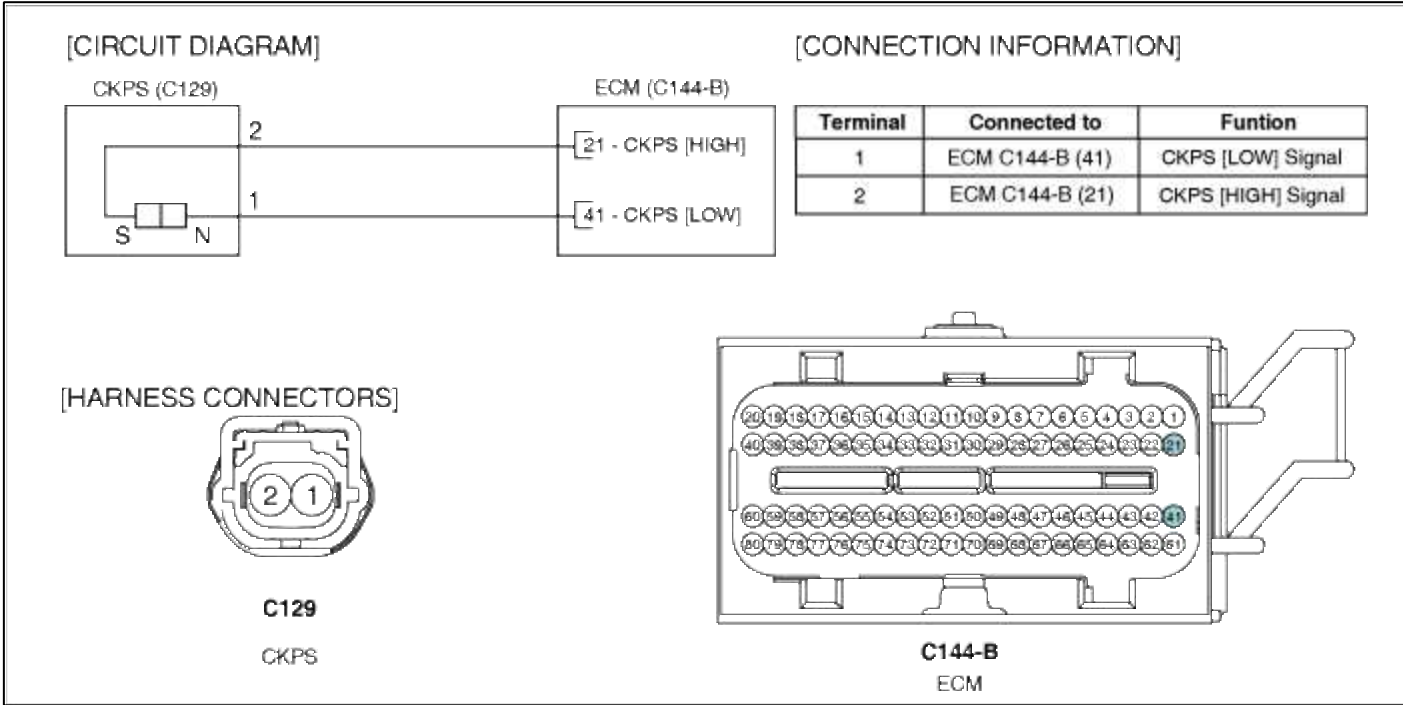
**SPECIFICATION**

Item	Specification
Coil Resistance ( $\Omega$ )	630 ~ 770 $\Omega$ at 20°C (68°F)
Air Gap (mm)	0.5 ~ 1.5

**WAVEFORM**



SCHEMATIC DIAGRAM



COMPONENT INSPECTION

1. Check signal waveform of CMPS and CKPS using a scantool.

Specification: Refer to "WAVE FORM"



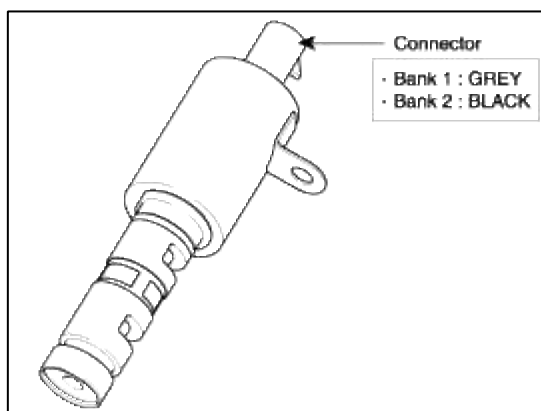
## SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System

### INSPECTION

### FUNCTION AND OPERATION PRINCIPLE

Continuously Variable Valve Timing (CVVT) system controls valve overlap with forcibly activating the camshaft and adjusts EGR (Exhaust Gas Recirculation) amount. It decreases exhaust gas (NO<sub>x</sub>, HC) and improves fuel economy, idle state, torque in low speed and power in high speed. This system uses engine oil pressure and consists of the two CVVT Oil Control Valve (OCV) in each bank which supplies oil to cam phaser according to PWM (Pulse With Modulator) signal of the PCM, a CVVT Oil Temperature Sensor (OTS) which detects the oil temperature and a cam phaser which is installed on the end of the camshaft and converts camshaft phase. The oil getting out of the CVVT oil control valve flows into the cam phaser and rotates the rotor inside cam phaser. At this time, the camshaft rotates with the rotor and the cam phase is changed.

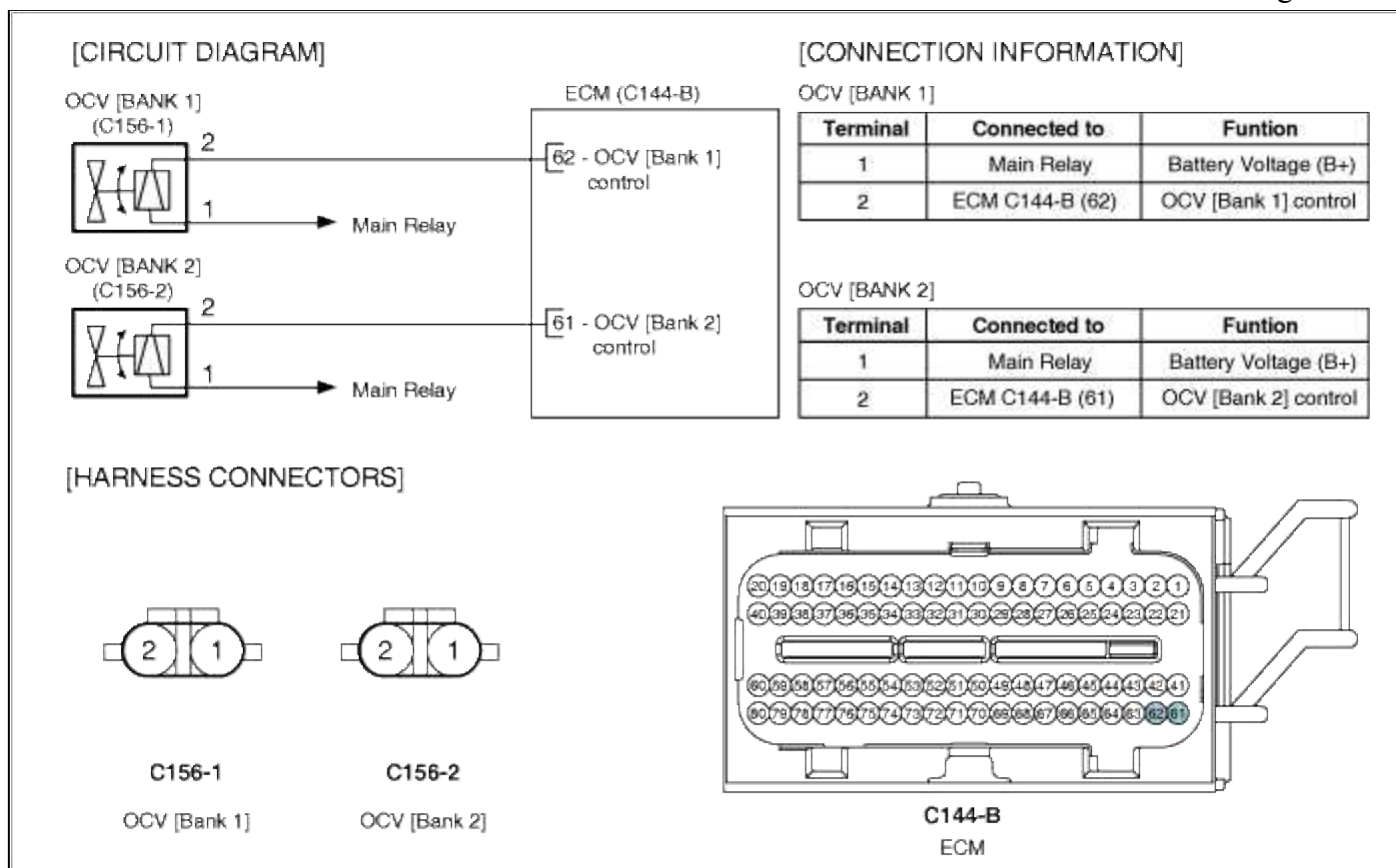
1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



### SPECIFICATION

Item	Specification
Coil Resistance ( $\Omega$ )	6.7 ~ 7.7 $\Omega$ at 20°C (68°F)

### SCHEMATIC DIAGRAM



## COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect OCV connector.
3. Measure resistance between OCV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

## INSTALLATION

### CAUTION

If the OCVs are installed incorrectly, the vehicle may be damaged.  
So when installing them, pay attention to its connector color (Components and harness side).

### [Bank and its color]

Bank	Component side	Harness side
Bank 1 (RH)	Grey	Grey
Bank 2 (LH)	Black	Black



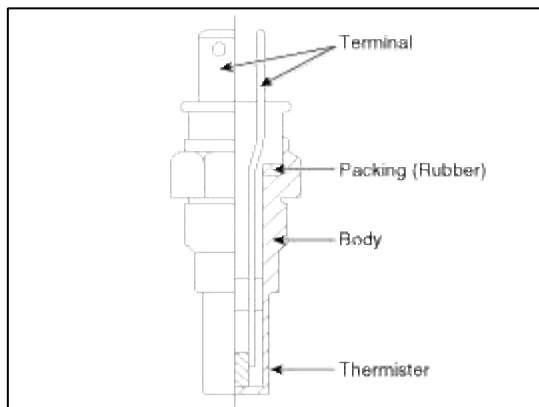
## SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System

### INSPECTION

### FUNCTION AND OPERATION PRINCIPLE

Continuously Variable Valve Timing (CVVT) system controls valve overlap by forcibly activating the camshaft and adjusts EGR (Exhaust Gas Recirculation) amount. It decreases exhaust gas (NO<sub>x</sub>, HC) and improves fuel economy, idle state, torque in low speed and power in high speed. This system uses engine oil pressure and consists of the two CVVT Oil Control Valves (OCV) in each bank which supplies oil to cam phaser according to PWM (Pulse With Modulation) signal of the PCM, a CVVT Oil Temperature Sensor (OTS) which detects the oil temperature and a cam phaser which is installed on the end of the camshaft and converts camshaft phase. The oil getting out of the CVVT oil control valve flows into the cam phaser and rotates the rotor inside camphaser. At this time, the camshaft rotates with the rotor and the cam phase is changed.

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance

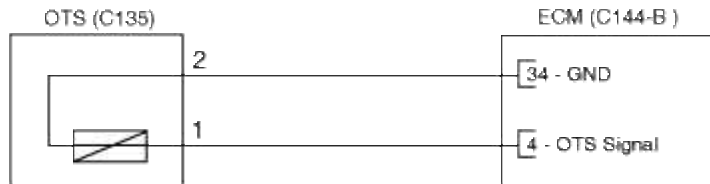


### SPECIFICATION

Temperature		Resistance(kΩ)
°C	°F	
-20	-4	16.52kΩ
20	32	2.45kΩ
80	176	0.29kΩ

### SCHEMATIC DIAGRAM

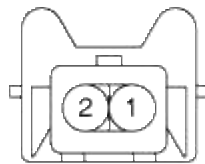
## [CIRCUIT DIAGRAM]



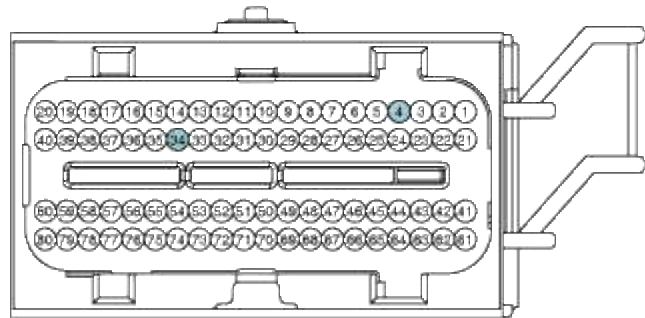
## [CONNECTION INFORMATION]

Terminal	Connected to	Funtion
1	ECM C144-B (4)	OTS Signal
2	ECM C144-B (34)	Sensor ground

## [HARNESS CONNECTORS]

**C135**

OTS

**C144-B**

ECM

## COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect OTS connector.
3. Remove the OTS.
4. After immersing the thermistor of the sensor into water (or engine coolant), measure resistance between OTS terminals 1 and 2.
5. Check that the resistance is within the specification.

---

Specification: Refer to SPECIFICATION.

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**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****OBD-II REVIEW****1. OVERVIEW**

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in California beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, Exhaust Gas Recirculation (EGR) system and additional emission related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the fault and the need for repair of the emission control system. Associated with the MIL was a fault code or Diagnostic Trouble Code (DTC) identifying the specific area of the fault.

The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations were followed until 1999 when the federal regulations were used.

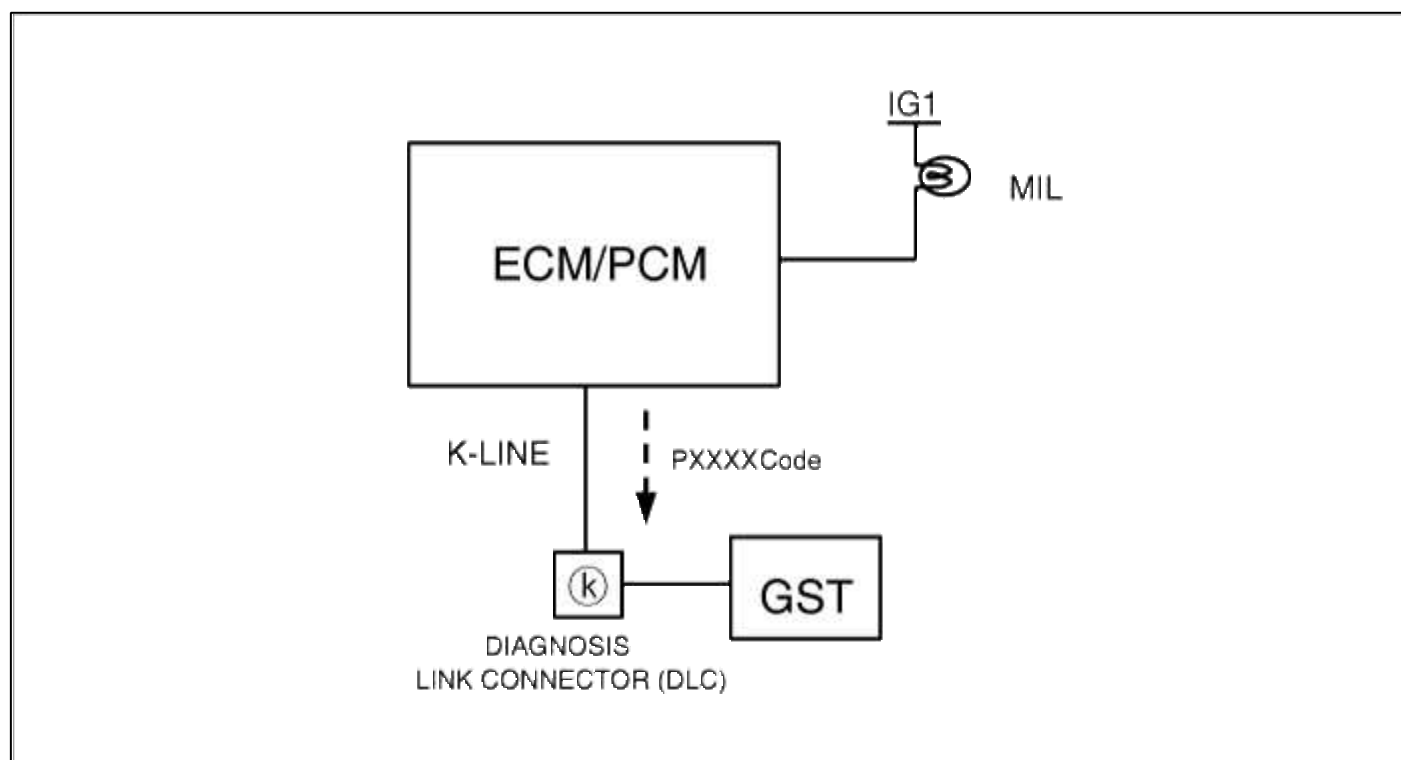
The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.

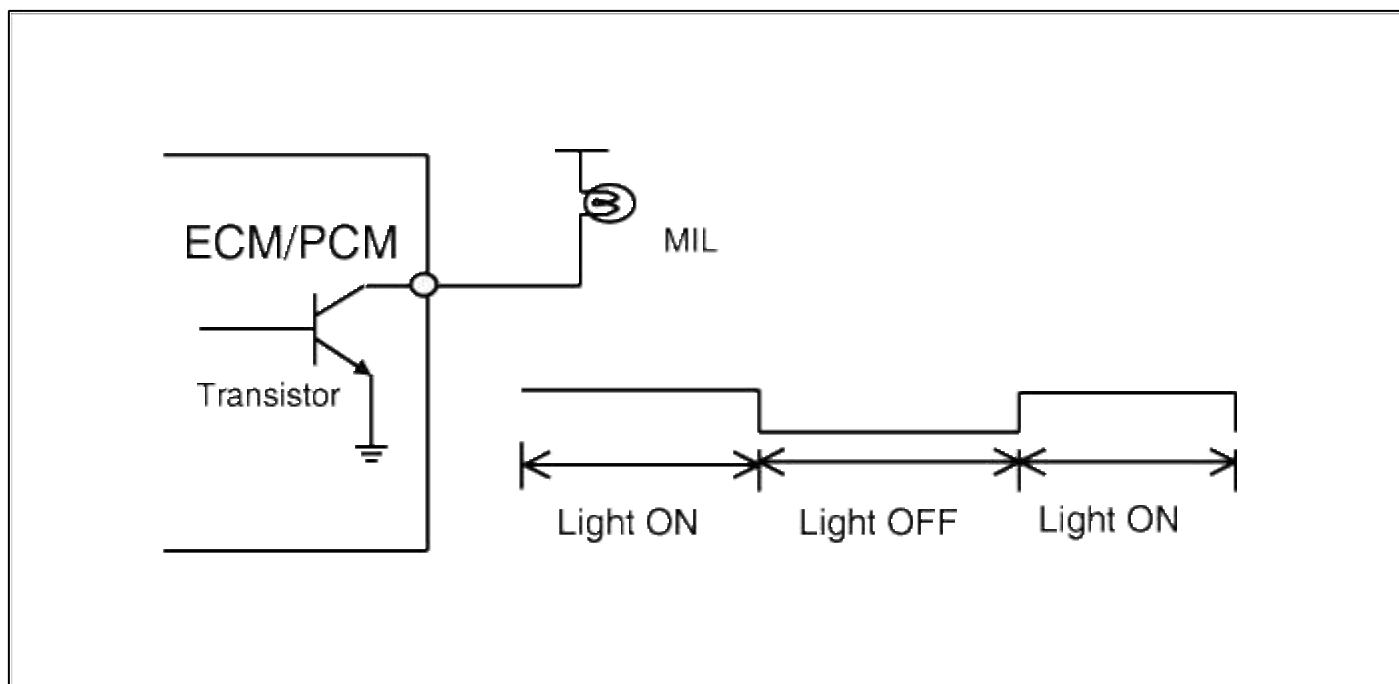
The diagnostic executive is a computer program in the Engine Control Module (ECM) or Powertrain Control Module (PCM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeze frame data and scan tool interface.

Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM, load and warm status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.

The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM) or Powertrain Control Module (PCM).

The ECM or PCM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random access memory, and others), the ECM or PCM generates output signals to control various relays, solenoids and actuators.

**2. CONFIGURATION OF HARDWARE AND RELATED TERMS**



The Malfunction Indicator Lamp (MIL) is connected between ECM or PCM-terminal Malfunction Indicator Lamp and battery supply (open collector amplifier).

In most cars, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit.

Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.

At ignition ON and engine revolution (RPM) < MIN. RPM, the MIL is switched ON for an optical check by the driver.

When the ECM or PCM detects a malfunction related emission during the first driving cycle, the DTC and engine data are stored in the freeze frame memory. The MIL is illuminated only when the ECM or PCM detects the same malfunction related to the DTC in two consecutive driving cycles.

- Misfire and Fuel System Malfunctions:

For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.

- All Other Malfunctions:

For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.

The diagnostic system may erase a fault code if the same fault is not re-registered in at least 40 engine warm-up cycles, and the MIL is not illuminated for that fault code.

- Bidirectional line
- K-Line is defined as the line which provides information in a serial digital form from ECM or PCM to the diagnostic tester. K-Line is used bidirectionally, in which case it may carry commands or data from the diagnostic tester to the ECM or PCM. K-Line is also used to initialize the serial communication.

A driving cycle consists of engine start up, and engine shut off.

A warm-up cycle means sufficient vehicle operation such that the engine coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit.

A trip means vehicle operation (following an engine-off period) of duration and driving mode such that all

components and systems are monitored at least once by the diagnostic system except catalyst efficiency or evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.

- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.

The letter of the beginning of the DTC identifies the function of the monitored device that has failed. A "P" indicates a powertrain device, "C" indicates a chassis device. "B" is for body device and "U" indicates a network or data link code. The first number indicates if the code is generic (common to all manufacturers) or if it is manufacturer specific. A "0" & "2" indicates generic, "1" indicates manufacturer-specific. The second number indicates the system that is affected with a number between 1 and 7.

The following is a list showing what numbers are assigned to each system.

1. Fuel and air metering
2. Fuel and air metering(injector circuit malfunction only)
3. Ignition system or misfire
4. Auxiliary emission controls
5. Vehicle speed controls and idle control system
6. Computer output circuits
7. Transmission

The last two numbers of the DTC indicates the component or section of the system where the fault is located. When a freeze frame event is triggered by an emission related DTC, the ECM or PCM stores various vehicle information as it existed the moment the fault occurred. The DTC number along with the engine data can be useful in aiding a technician in locating the cause of the fault. Once the data from the 1st driving cycle DTC occurrence is stored in the freeze frame memory, it will remain there even when the fault occurs again (2nd driving cycle) and the MIL is illuminated.

- Freeze Frame List
  - 1) Calculated Load Value
  - 2) Engine RPM
  - 3) Fuel Trim
  - 4) Fuel Pressure (if available)
  - 5) Vehicle Speed (if available)
  - 6) Coolant Temperature
  - 7) Intake Manifold Pressure (if available)
  - 8) Closed-or Open-loop operation
  - 9) Fault code

### 3. OBD-II SYSTEM READINESS TESTS

The catalyst efficiency monitor is a self-test strategy within the ECM or PCM that uses the downstream Heated Oxygen Sensor (HO2S) to determine when a catalyst has fallen below the minimum level of effectiveness in its ability to control exhaust emission.

Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering, or poor compression. Any combustion that does not occur within the cylinder at the proper time is also a misfire. The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalyst from permanent damage and to alert the customer of an emission failure or an inspection maintenance failure by illuminating the MIL . When a misfire is detected, special software called freeze frame data is enabled. The freeze frame data captures the operational state of the vehicle when a fault is detected from misfire detection monitor strategy.



The fuel system monitor is a self-test strategy within the ECM or PCM that monitors the adaptive fuel table. The fuel control system uses the adaptive fuel table to compensate for normal variability of the fuel system components caused by wear or aging. During normal vehicle operation, if the fuel system appears biased lean or rich, the adaptive value table will shift the fuel delivery calculations to remove bias.

The cooling system monitoring is a self-test strategy within the ECM or PCM that monitors ECTS (Engine Coolant Temperature Sensor) and thermostat about circuit continuity, output range, rationality faults.

OBD-II regulations require monitoring of the upstream Heated O<sub>2</sub> Sensor (H<sub>2</sub>OS) to detect if the deterioration of the sensor has exceeded thresholds. An additional HO<sub>2</sub>S is located downstream of the Warm-Up Three Way Catalytic Converter (WU-TWC) to determine the efficiency of the catalyst.

Although the downstream H<sub>2</sub>OS is similar to the type used for fuel control, it functions differently. The downstream HO<sub>2</sub>S is monitored to determine if a voltage is generated. That voltage is compared to a calibrated acceptable range.

The EVAP. monitoring is a self-test strategy within the ECM or PCM that tests the integrity of the EVAP. system.

The complete evaporative system detects a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.040 inch and 0.020 inch diameter orifice.

The A/C system monitoring is a self-test strategy within the ECM or PCM that monitors malfunction of all A/C system components at A/C ON.

The comprehensive components monitoring is a self-test strategy within the ECM or PCM that detects fault of any electronic powertrain components or system that provides input to the ECM or PCM and is not exclusively an input to any other OBD-II monitor.

**Requirement:**

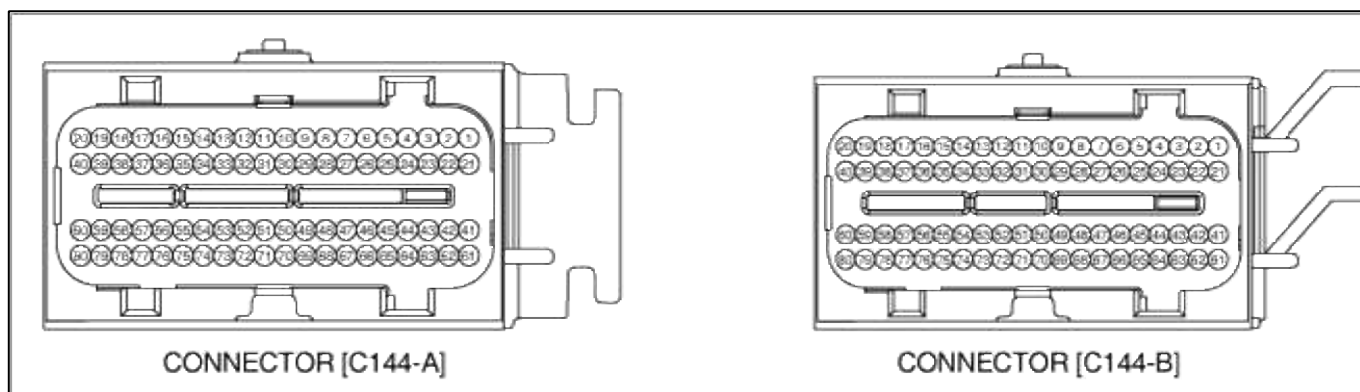
If a vehicle incorporates an engine control strategy that alters off idle fuel and/or spark control when the A/C system is on, the OBD II system shall monitor all electronic air conditioning system components for malfunctions that cause the system to fail to invoke the alternate control while the A/C system is on or cause the system to invoke the alternate control while the A/C system is off.

Additionally, the OBD II system shall monitor for malfunction all electronic air conditioning system components that are used as part of the diagnostic strategy for any other monitored system or component.

**Implementation plan:**

No engine control strategy incorporated that alters off idle fuel and/or spark control when A/C system is on.

Malfunction of A/C system components is not used as a part of the diagnostic strategy for other monitored system or component.

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****ENGINE CONTROL MODULE (ECM)****1. ECM HARNESS CONNECTOR****2. ECM TERMINAL FUNCTION****CONNECTOR [C144-A]**

Pin No.	Description	Connected to
1	2nd CAN [High]	Multi-Purpose Check Connector
2	2nd CAN [Low]	Multi-Purpose Check Connector
3	-	
4	-	
5	-	
6	-	
7	-	
8	-	
9	-	
10	Power Steering Switch Signal input	Power Steering Switch
11	-	
12	-	
13	-	
14	-	
15	Alternator load signal input	Alternator
16	Cruise Switch ground	Cruise Switch
17	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
18	Air conditioner switch "ON" signal input	Air Conditioner Control Module
19	-	
20	-	
21	Brake switch signal input	Brake Switch
22	-	
23	Brake lamp signal input	Brake Lamp
24	-	

25	Cruise Switch signal input	Cruise Switch
26	Air conditioner blower switch signal input	Air Conditioner Control Module
27	Diagnostic Data Line (K-Line)	Data Link Connector (DLC), Multi-Purpose Check Connector
28	Fuel Tank Pressure Sensor signal input	Fuel Tank Pressure Sensor (FTPS)
29	Fuel Level signal input	Fuel Lever Sensor (FLS) [in Fuel Pump]
30	-	
31	-	
32	A/C Pressure Transducer signal input	A/C Pressure Transducer (APT)
33	Sensor ground	A/C Pressure Transducer (APT)
34	-	
35	-	
36	-	
37	Canister Close Valve control output	Canister Close Valve (CCV)
38	Battery voltage supply after main relay	Main Relay
39	Battery voltage supply after main relay	Main Relay
40	Battery voltage supply after main relay	Main Relay
41	CAN [High]	ABS/ESC Control Module, AWD Control Module
42	CAN [Low]	ABS/ESC Control Module, AWD Control Module
43	Main Relay control output	Main Relay
44	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
45	Immobilizer communication line	Immobilizer
46	-	
47	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)
48	Sensor Ground	Accelerator Position Sensor (APS) #2
49	Accelerator Position Sensor #2 signal input	Accelerator Position Sensor (APS) #2
50	-	
51	Cruise "SET" lamp control output	Cruise "SET" Lamp (Cluster)
52	Vehicle speed signal input	ABS/ESP Control Module (With ABS/ESC)
53	Sensor ground	Intake Air Temperature Sensor (IATS)
54	Accelerator Position Sensor #1 signal input	Accelerator Position Sensor (APS) #1
55	Sensor ground	Accelerator Position Sensor (APS) #1
56	Sensor Power (+5V)	Fuel Tank Pressure Sensor (FTPS)
57	Sensor power (+5V)	Accelerator Position Sensor (APS) #2
58	Sensor power (+5V)	A/C pressure Transducer (APT)
59	Sensor Power (+5V)	Accelerator Position Sensor (APS) #1

60	-	
61	Engine speed signal output	Cluster (Tachometer)
62	Fuel consumption signal output	Trip Computer
63	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)
64	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay
65	Cooling Fan Relay [Low] control output	Cooling Fan Relay [Low]
66	Cooling Fan Relay [High] control output	Cooling Fan Relay [High]
67	For Autotransaxle Control	
68	Throttle Position Sensor signal (PWM) output	ABS Control Module, ESC Control Module
69	Cruise "MAIN" lamp control output	Cruise "MAIN" Lamp (Cluster)
70	Fuel Pump Relay control output	Fuel Pump Relay
71	Variable Intake Solenoid Valve control output	Variable Intake Solenoid (VIS) Valve
72	Immobilizer lamp control output	Immobilizer Lamp
73	-	
74	-	
75	-	
76	-	
77	-	
78	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
79	Wheel Speed Sensor [Low] signal input	Wheel Speed Sensor (WSS)(Without ABS/ESC)
80	Wheel Speed Sensor [High] signal input	Wheel Speed Sensor (WSS)(Without ABS/ESC)

**CONNECTOR [C144-B]**

Pin No.	Description	Connected to
1	ETC Motor [-] control output	ETC Motor (in ETC Module)
2	ETC Motor [+] control output	ETC Motor (in ETC Module)
3	-	
4	CVVT Oil Temperature Sensor signal input	CVVT Oil Temperature Sensor (OTS)
5	-	
6	For Autotransaxle Control	
7	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)
8	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)
9	-	
10	-	
11	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)

12	Battery voltage supply after ignition switch	Ignition Switch
13	Sensor power (+5V)	Throttle Position Sensor (TPS) #2
14	Sensor ground	Throttle Position Sensor (TPS) #1
15	Sensor power (+5V)	Camshaft Position Sensor (CMPS) [Bank 2]
16	Sensor power (+5V)	Throttle Position Sensor (TPS) #1
17	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 2]
18	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1]
19	Ignition Coil (Cylinder #6) control output	Ignition Coil (Cylinder #6)
20	-	
21	Crankshaft Position Sensor [High] signal input	Crankshaft Position Sensor (CKPS)
22	-	
23	Sensor Shield	Crankshaft Position Sensor (CKPS), Knock Sensor (KS) #1,2
24	Camshaft Position Sensor [Bank 2] signal input	Camshaft Position Sensor (CMPS) [Bank 2]
25	Camshaft Position Sensor [Bank 1] signal input	Camshaft Position Sensor (CMPS) [Bank 1]
26	-	
27	-	
28	Sensor ground	HO2S (B2/S1)
29	Sensor ground	HO2S (B2/S2)
30	Sensor ground	HO2S (B1/S1)
31	Sensor ground	HO2S (B1/S2)
32	Sensor power (+5V)	Camshaft Position Sensor (CMPS) [Bank 1]
33	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
34	Sensor ground	Manifold Absolute Pressure Sensor (MAPS), CVVT Oil Temperature Sensor (OTS)
35	Power ground	Chassis Ground
36	Power ground	Chassis Ground
37	Power ground	Chassis Ground
38	Power ground	Chassis Ground
39	Power ground	Chassis Ground
40	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)
41	Crankshaft Position Sensor [Low] signal input	Crankshaft Position Sensor (CKPS)
42	-	
43	-	
44	-	
45	-	
46	-	
47	-	

48	Throttle Position Sensor #1 signal input	Throttle Position Sensor (TPS) #1
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	HO2S (B1/S1)
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	HO2S (B1/S2)
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	HO2S (B2/S1)
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	HO2S (B2/S2)
53	Knock Sensor (KS) #2 [High] signal input	Knock Sensor (KS) #2 [High]
54	Knock Sensor (KS) #2 [Low] signal input	Knock Sensor (KS) #2 [Low]
55	Knock Sensor (KS) #1 [Low] signal input	Knock Sensor (KS) #1 [Low]
56	Knock Sensor (KS) #1 [High] signal input	Knock Sensor (KS) #1 [High]
57	Throttle Position Sensor #2 signal input	Throttle Position Sensor (TPS) #2
58	Sensor ground	Throttle Position Sensor (TPS) #2
59	-	
60	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)
61	CVVT Oil Control Valve [Bank 2] control output	CVVT Oil Control Valve (OCV) [Bank 2]
62	CVVT Oil Control Valve [Bank 1] control output	CVVT Oil Control Valve (OCV) [Bank 1]
63	Injector (Cylinder #2) control output	Injector (Cylinder #2)
64	Injector (Cylinder #3) control output	Injector (Cylinder #3)
65	-	
66	-	
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	HO2S (B2/S1)
68	Injector (Cylinder #4) control output	Injector (Cylinder #4)
69	Injector (Cylinder #5) control output	Injector (Cylinder #5)
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	HO2S (B1/S1)
71	Injector (Cylinder #6) control output	Injector (Cylinder #6)
72	Injector (Cylinder #1) control output	Injector (Cylinder #1)
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	HO2S (B2/S2)
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	HO2S (B1/S2)
75	-	
76	Power Supply (B+)	Battery
77	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)

78	Ignition Coil (Cylinder #5) control output	Ignition Coil (Cylinder #5)
79	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)
80	-	

### 3. ECM TERMINAL INPUT/OUTPUT SIGNAL CONNECTOR [C144-A]

Pin No.	Description	Condition	Type	Level	Test Result
1	2nd CAN [High]	Idle	DC	2.0 ~ 3.0V	2.5V
2	2nd CAN [Low]	Idle	DC	2.0 ~ 3.0V	2.5V
3	-				
4	-				
5	-				
6	-				
7	-				
8	-				
9	-				
10	Power Steering Swiech signal input				
11	-				
12	-				
13	-				
14	-				
15	Alternator load signal input	Idle	PULSE	High: Battery Voltage	13.6V
				Low: Max. 1.5V	0V
				140 ~ 190Hz	160Hz
16	Cruise Switch ground				
17	Sensor ground	Idle	DC	Max. 50mV	30mV
18	Air conditioner switch "ON" signal input	A/C Relay OFF	DC	Battery Voltage	9.1V
		A/C Relay ON		Max. 1.0V	0.1V
19	-				
20	-				

21	Brake switch signal input	Brake pedal releasing	DC	Battery Voltage	12.7V
		Brake pedal pressing		Max. 0.5V	0.03V
22	-				
23	Brake lamp signal input	Brake pedal releasing	DC	Max. 0.5V	0V
		Brake pedal pressing		Battery Voltage	13.0V
24	-				
25	Cruise Switch signal input				
26	Air conditioner blower switch signal input	A/C OFF	DC	Max. 1.0V	0V
		A/C ON		Battery Voltage	11.9V
27	Diagnostic Data Line (K-Line)	When transmitting	PULSE	High: Min. Vbatt 80%	11.3V
				Low: Max. Vbatt 20%	0.14V
		When receiving		High: Min. Vbatt 70%	11.3V
				Low: Max. Vbatt 30%	0.32V
28	Fuel Tank Pressure Sensor signal input	Idle	DC	0.4 ~ 4.6V	2.5V
29	Fuel Lever signal input				
30	-				
31	-				
32	Air Conditioner Pressure Sensor signal input	A/C OFF	DC	0 ~ 5.0V	
		A/C ON			1.85 ~ 2.2V
33	Sensor ground	Idle	DC	Max. 50mV	40mV
34	-				
35	-				
36	-				
37	Canister Close Valve control output	Active Inactive	PULSE	High: Battery Voltage	14.0V
				Low: Max. 1.0V	170mV



38	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
39	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
40	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.1V
41	CAN [High]	RECESSIVE	PULSE	2.0 ~ 3.0V	3.85V
		DOMINANT		2.75~4.5V	2.5V
42	CAN [Low]	RECESSIVE	PULSE	2.0 ~ 3.0V	2.55V
		DOMINANT		2.75~4.5V	1.34V
43	Main Relay control output	Relay ON	DC	Battery Voltage	12.3V
		Relay OFF		Max. 1.0V	0.87V
44	Intake Air Temperature Sensor signal input	Idle	Analog	0 ~ 5.0V	1.86V
45	Immobilizer communication line				
46	-				
47	Mass Air Flow Sensor signal input	Idle	PULSE	High: Vref	5.04V
				Low: Max. 0.5V	0.27V
				Idle: 3.0KHz	
		3,000 rpm		High: Vref	5.04V
				Low: Max. 0.5V	0.27V
				3000rpm: 4.5 kHz	
48	Sensor ground	Idle	DC	Max. 50mV	35mV
49	Accelerator Position Sensor #2 signal input	C.T	Analog	0.3 ~ 0.9V	0.4V
		W.O.T		1.5 ~ 3.0V	2.1V
50	-				
51	Cruise "SET" lamp control output				
52	Vehicle speed signal input	Vehicle running	PULSE	High: Min. 5.0V	12.6V
				Low: Max. 1.0V	0.2V
53	Sensor ground	Idle	DC	Max. 50mV	34mV

54	Accelerator Position Sensor #1 signal input	C.T	Analog	0.3 ~ 0.9V	0.77V
		W.O.T		4.0 ~ 4.8V	4.23V
55	Sensor ground	Idle	DC	Max. 50mV	36mV
56	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
57	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
58	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
59	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
60	-				
61	Engine speed signal output	Idle	PULSE	High: Battery Voltage	13.0V
				Low: Max. 0.5V	0V
				20~26Hz	35Hz
62	Fuel consumption signal output	Idle	PULSE	High: Battery Voltage or Vref	12.8V
				Low: Max. 0.5V	0V
63	Malfunction Indicator Lamp (MIL) control output	MIL OFF	DC	High: Battery Voltage	4.24V
		MIL ON		Low: Max. 2.0V	0V
64	Air Conditioner Compressor Relay control output	A/C OFF	DC	Battery Voltage	13.0V
		A/C ON		Max. 1.0V	0.14V
65	Cooling Fan Relay [Low] control output				
66	Cooling Fan Relay [High] control output				
67	-				
68	Throttle Position Sensor signal (PWM) output	Idle	PULSE	High: Battery Voltage	12.3V
				Low: 0 ~ 0.5 V	0V

					100Hz
69	Cruise "CRUISE" lamp control output				
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	12.5V
		Relay ON		Max. 1.0V	0.09V
71	Variable Intake Solenoid Valve control output	Active	DC	Max. 1.0V	0.1V
		Inactive		Battery Voltage	12.4V
72	Immobilizer lamp control output				
73	-				
74	-				
75	-				
76	-				
77	-				
78	Purge Control Solenoid Valve control output	Inactive Active	PULSE	High: Battery Voltage	13.2V
				Low: Max. 1.0V	0.08V
					16Hz
79	Wheel Speed Sensor [Low] signal input				
80	Wheel Speed Sensor [High] signal input				

**CONNECTOR [C144-B]**

Pin No.	Description	Condition	Type	Level	Test Result
1	ETC Motor [-] control output	Idle	PULSE	High: Battery Voltage	13.3V
				Low: Max. 1.0V	0.3V
					3.14KHz
2	ETC Motor [+] control output	Idle	PULSE	High: Battery Voltage	13.3V
				Low: Max. 1.0V	0.4V
					3.14KHz
3	-				
4	CVVT Oil Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	1.68V
5	-				

6	-				
7	Engine Coolant Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	0.47V
8	Manifold Absolute Pressure Sensor signal input	IG ON	Analog	3.9 ~ 4.1V	4.01V
		Idle		0.8 ~ 1.6V	1.59V
9	-				
10	-				
11	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.08V
12	Battery voltage supply after ignition switch	IG OFF	DC	Max. 0.5V	0V
		IG ON		Battery Voltage	12.2V
13	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.05V
14	Sensor ground	Idle	DC	Max. 50mV	30mV
15	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
16	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
17	Sensor ground	Idle	DC	Max. 50mV	30mV
18	Sensor ground	Idle	DC	Max. 50mV	30mV
19	Ignition Coil (Cylinder #6) control output	Idle	PULSE	1st: 300~400V	272V
				ON: Max. 2V	1.2V
					5.8Hz
20	-				
21	Crankshaft Position Sensor [High] signal input	Idle	Sine Wave	Vp_p: Min.1.0V	8V
					700Hz
22	-				
23	Sensor Shield	Idle	DC	Max. 50mV	32mV
24	Camshaft Position Sensor [Bank 2] signal input	Idle	PULSE	High: Vref	5.08V
				Low: Max. 0.5V	0.06V
					40Hz
				High: Vref	5.08V

25	Camshaft Position Sensor [Bank 1] signal input	Idle	PULSE	Low: Max. 0.5V	0.06V
					40Hz
26	-				
27	-				
28	Sensor ground	Idle	DC	Max. 50mV	27mV
29	Sensor ground	Idle	DC	Max. 50mV	27mV
30	Sensor ground	Idle	DC	Max. 50mV	26V
31	Sensor ground	Idle	DC	Max. 50mV	27mV
32	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.06V
33	Sensor ground	Idle	DC	Max. 50mV	13mV
34	Sensor ground	Idle	DC	Max. 50mV	13mV
35	Power ground	Idle	DC	Max. 50mV	0mV
36	Power ground	Idle	DC	Max. 50mV	0mV
37	Power ground	Idle	DC	Max. 50mV	0mV
38	Power ground	Idle	DC	Max. 50mV	2mV
39	Power ground	Idle	DC	Max. 50mV	2mV
40	Ignition Coil (Cylinder #4) control output	Idle	PULSE	1st: 300~400V	263V
				ON: Max. 2V	1.4V
					5.8Hz
41	Crankshaft Position Sensor [Low] signal input	Idle	Sine Wave	Vp_p: Min.1.0V	8V
					700Hz
42	-				
43	-				
44	-				
45	-				

46	-				
47	-				
48	Throttle Position Sensor #1 signal input	C.T	Analog	0.25 ~ 0.9V	
		W.O.T		Min. 4.0V	
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.95V
				Lean: 0 ~ 0.4V	0.13V
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.88V
				Lean: 0 ~ 0.4V	0.21V
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.91V
				Lean: 0 ~ 0.4V	0.18V
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	Engine Running	DC	Rich: 0.6 ~ 1.0V	0.89V
				Lean: 0 ~ 0.4V	0.22V
53	Knock Sensor (KS) #2 [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
54	Knock Sensor (KS) #2 [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
55	Knock Sensor (KS) #1 [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V\
		Normal		0 V	
56	Knock Sensor (KS) #1 [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	1.7V
		Normal		0 V	
57	Throttle Position Sensor #2 signal input	C.T	Analog	Min. 4.0V	
		W.O.T		0.25 ~ 0.9V	
58	Sensor ground	Idle	DC	Max. 50mV	17mV
59	-				
				1st: 300~400V	266V

60	Ignition Coil (Cylinder #2) control output	Idle	PULSE	ON: Max. 2V	1.3V
					5.8Hz
61	CVVT Oil Control Valve [Bank 2] control output	Idle	PULSE	Battery Voltage	14.5V
				Max. 1.0V	0.1V
				Duty variance when operating the accelerator	128Hz
62	CVVT Oil Control Valve [Bank 1] control output	Idle	PULSE	Battery Voltage	14.3V
				Max. 1.0V	0.1V
				Duty variance when operating the accelerator	128Hz
63	Injector (Cylinder #2) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	57.5V
					5.8Hz
64	Injector (Cylinder #3) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
65	-				
66	-				
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.17V

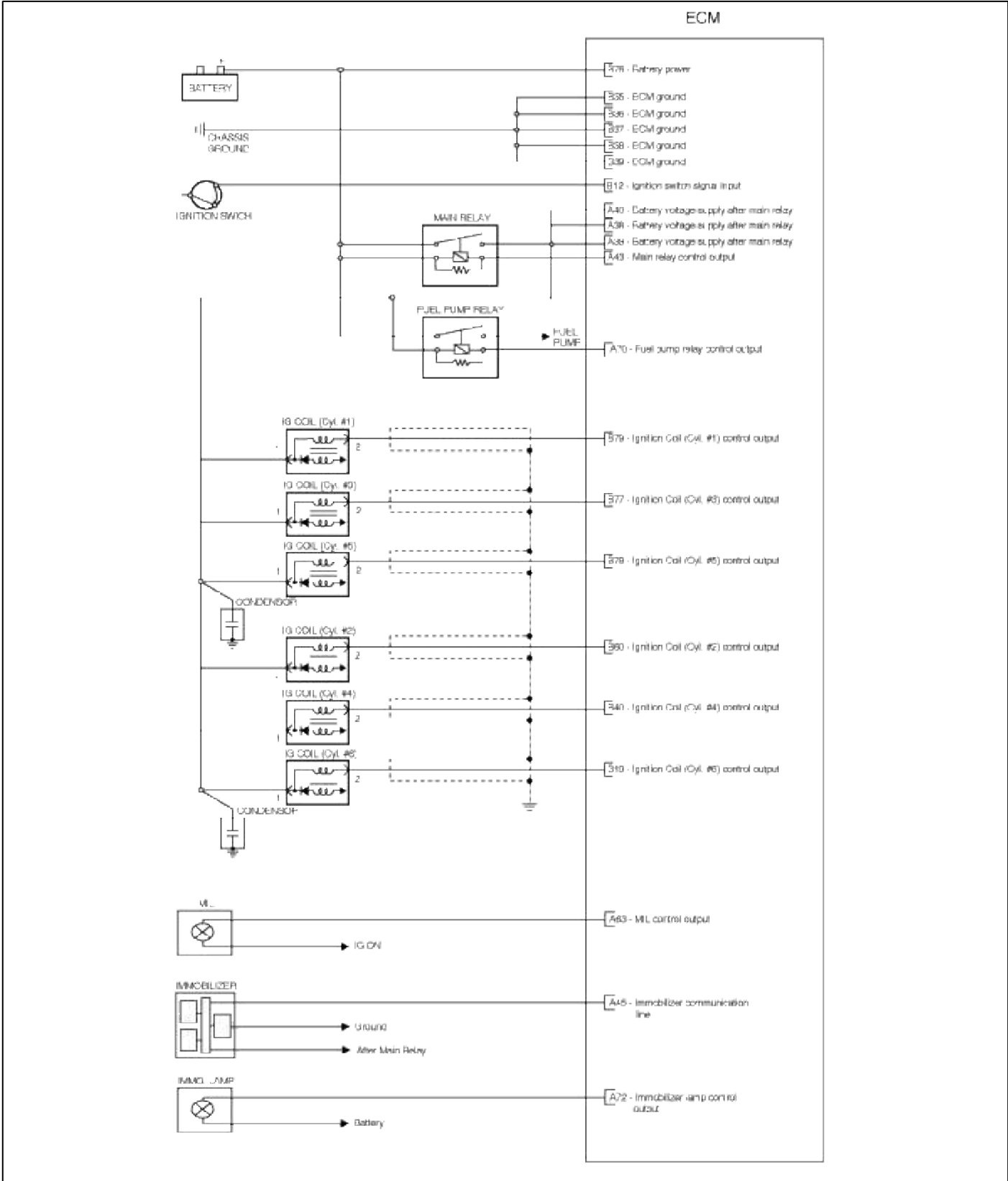
					16Hz
68	Injector (Cylinder #4) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
69	Injector (Cylinder #5) control output	Idle	PULSE	High: Battery Voltage	13.7V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.17V
					16Hz
71	Injector (Cylinder #6) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
72	Injector (Cylinder #1) control output	Idle	PULSE	High: Battery Voltage	13.8V
				Low: Max. 1.0V	0.13V
				Vpeak: Max. 80V	56.8V
					5.8Hz
73	Heated Oxygen Sensor [Bank 2 / Sensor 2]	Engine		High: Battery Voltage	13.9V

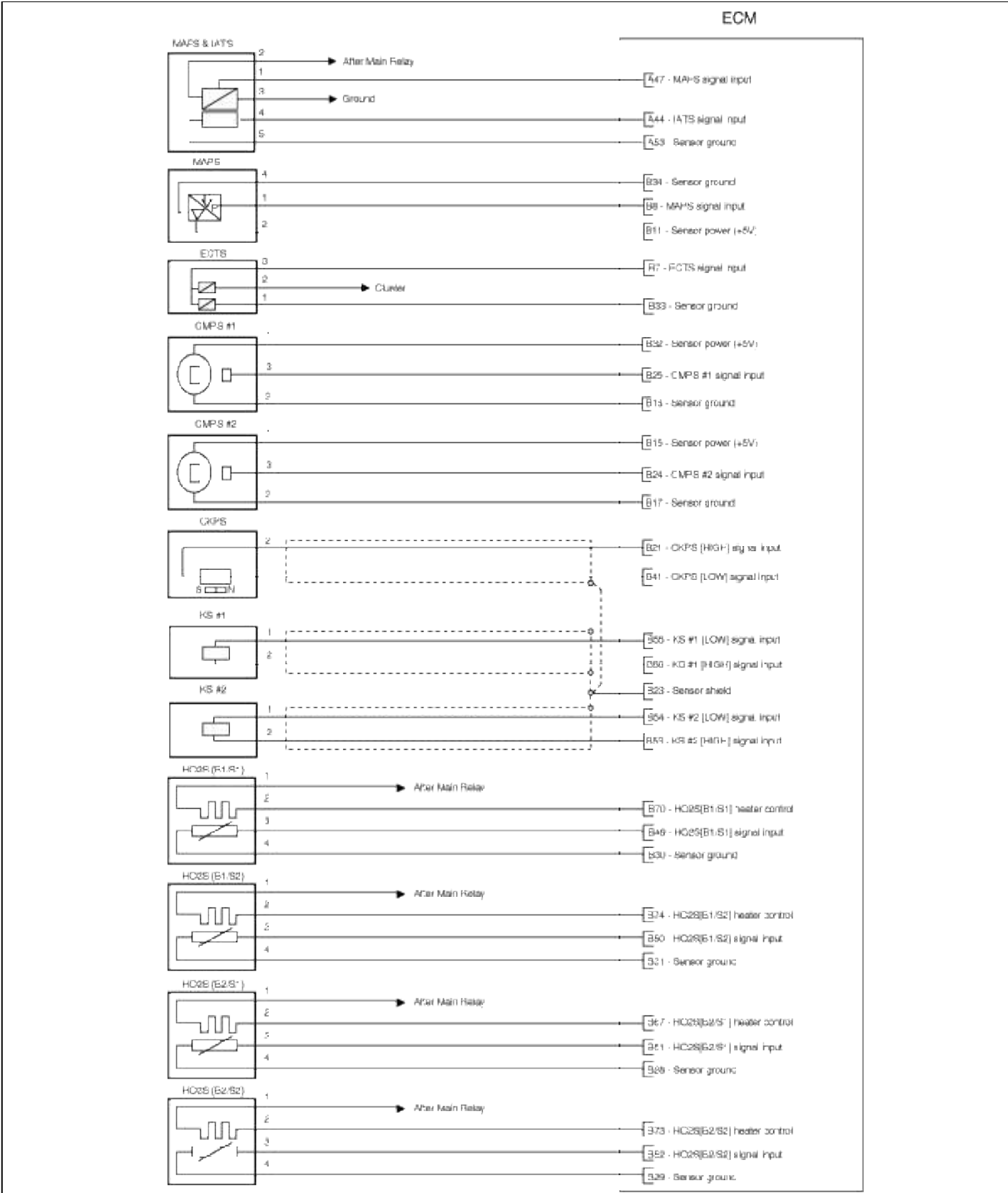


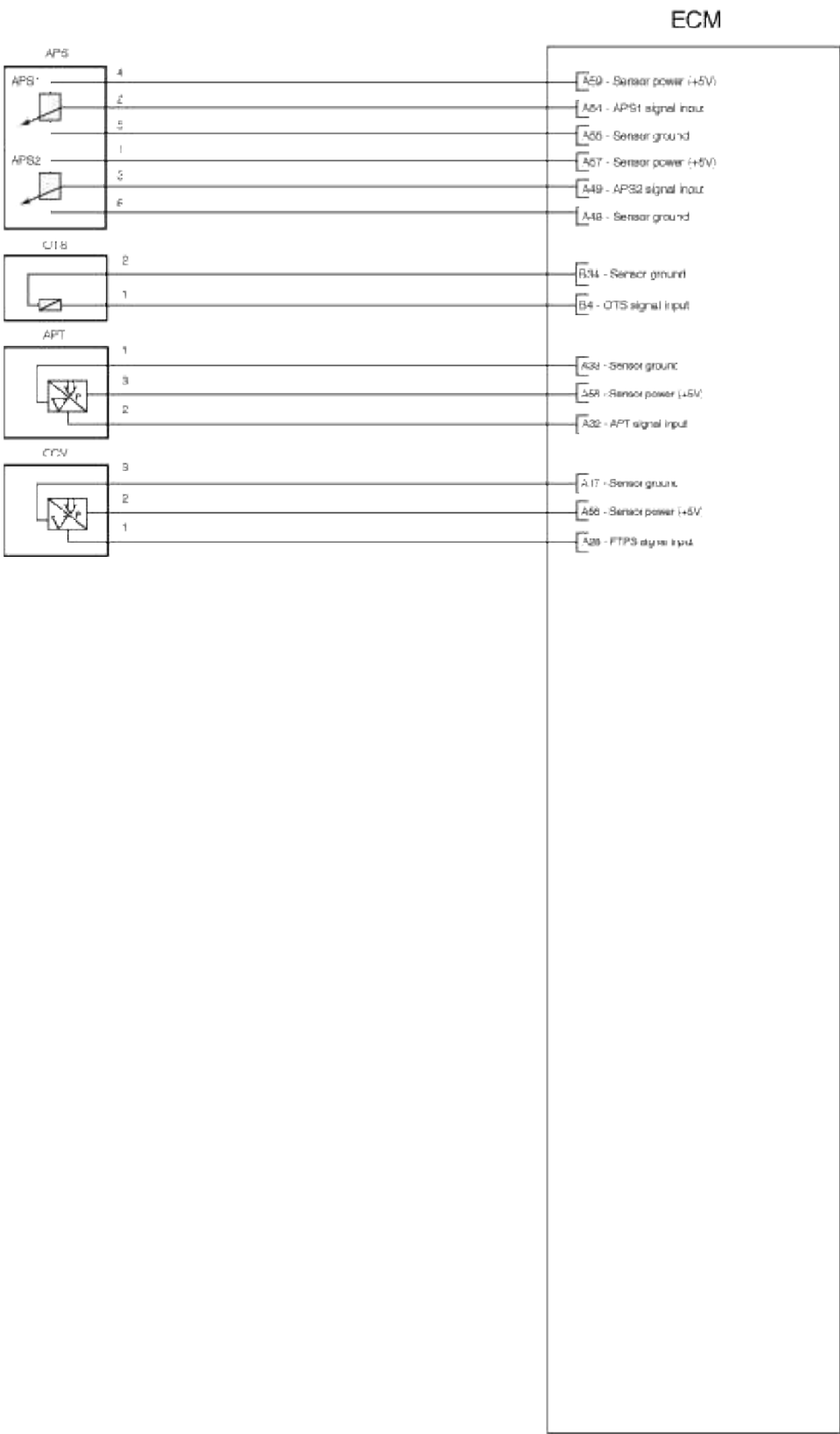
73	Heater control output	Running	PULSE	Low: Max. 1.0V	0.19V
					16Hz
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	Engine Running	PULSE	High: Battery Voltage	13.9V
				Low: Max. 1.0V	0.18V
					16Hz
75	-				
76	Power Supply (B+)	Always	DC	Battery Voltage	13.0V
77	Ignition Coil (Cylinder #3) control output	Idle	PULSE	1st: 300~400V	266V
				ON: Max. 2V	1.4V
					5.8Hz
78	Ignition Coil (Cylinder #5) control output	Idle	PULSE	1st: 300~400V	267V
				ON: Max. 2V	1.4V
					5.8Hz
79	Ignition Coil (Cylinder #1) control output	Idle	PULSE	1st: 300~400V	268V
				ON: Max. 2V	1.4V
					5.8Hz
80	-				

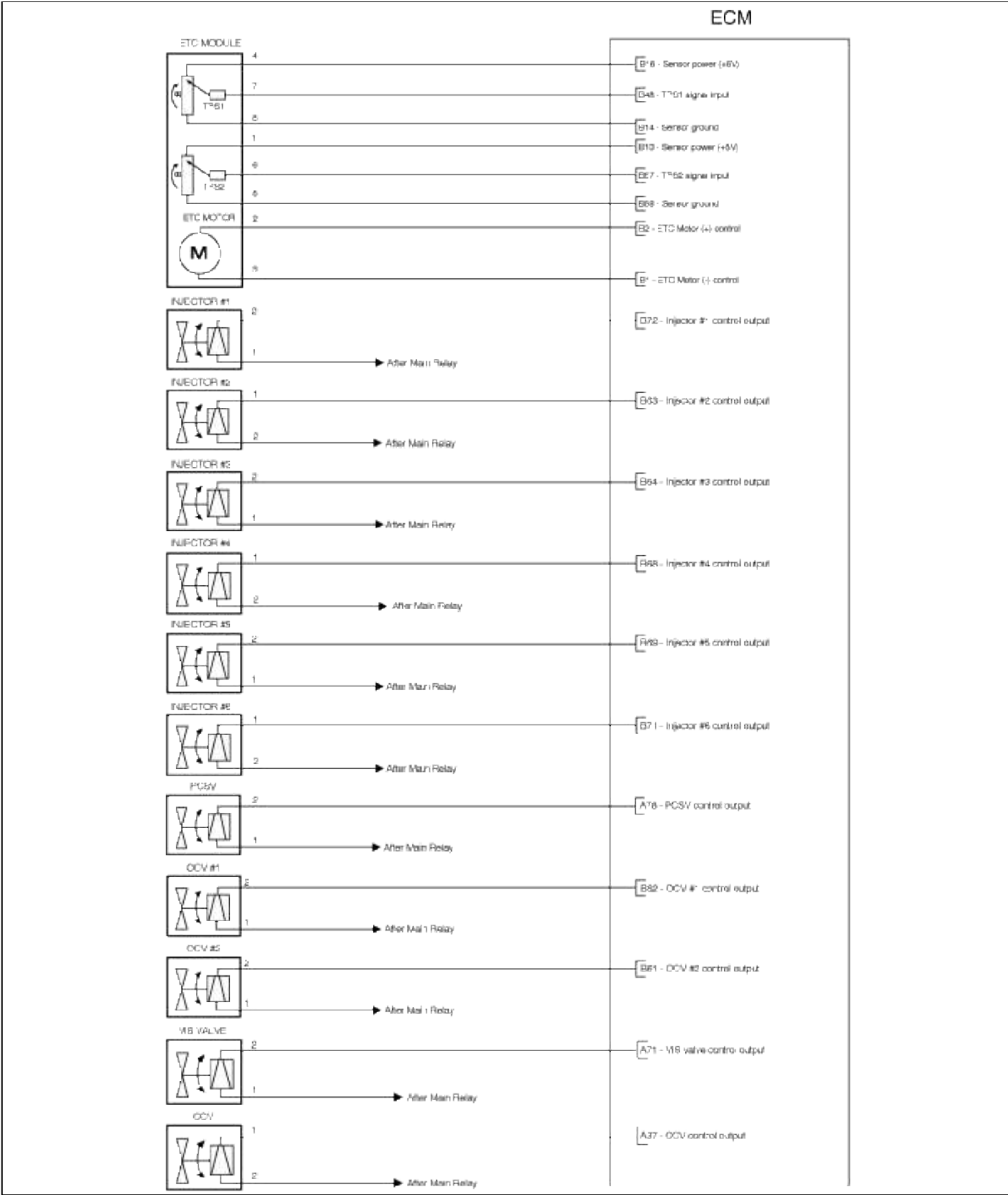
SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System

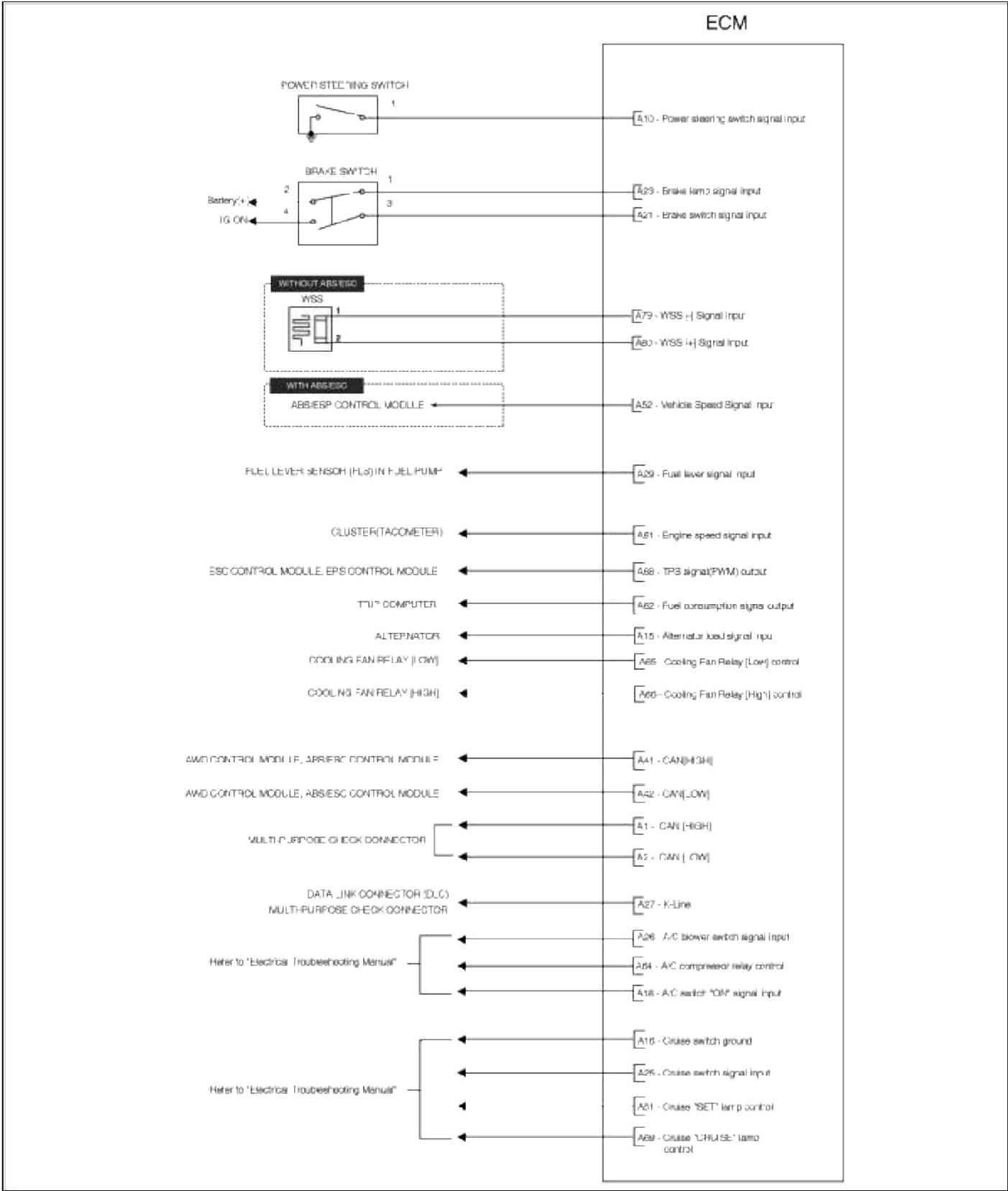
CIRCUIT DIAGRAM





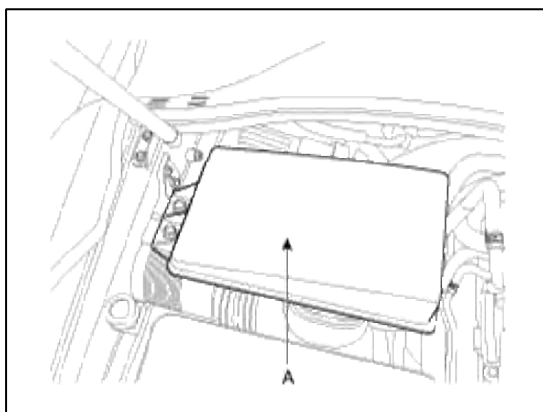




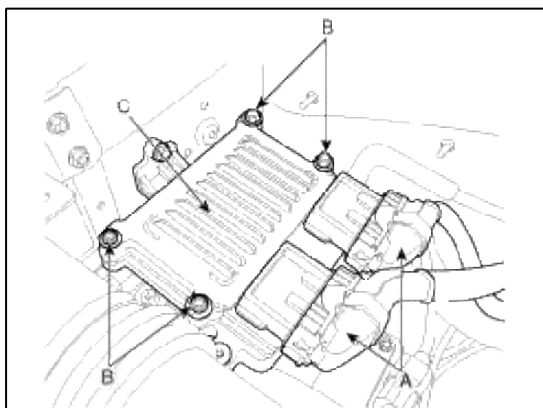


**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****REPLACEMENT**

1. Turn ignition switch off.
2. Disconnect the battery (-) cable from the battery.
3. Remove the resonator (A).



4. Disconnect the ECM connectors (A).



5. Unscrew the ECM mounting bolts (B) and remove the ECM from the bracket (C).
6. Install a new ECM

---

ECM installation bolts : 9.8 ~ 11.8 N·m (1.0 ~ 1.2 kgf·m, 7.2 ~ 8.7 lbf·ft)

---

**ECM PROBLEM INSPECTION PROCEDURE**

1. **TEST ECM GROUND CIRCUIT:** Measure resistance between ECM and chassis ground using the backside of ECM harness connector as ECM side check point. If the problem is found, repair it.

---

Specification (Resistance): 1Ω or less

---

2. **TEST ECM CONNECTOR:** Disconnect the ECM connector and visually check the ground terminals on ECM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, replace the ECM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the PCM.
4. **RE-TEST THE ORIGINAL ECM :** Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

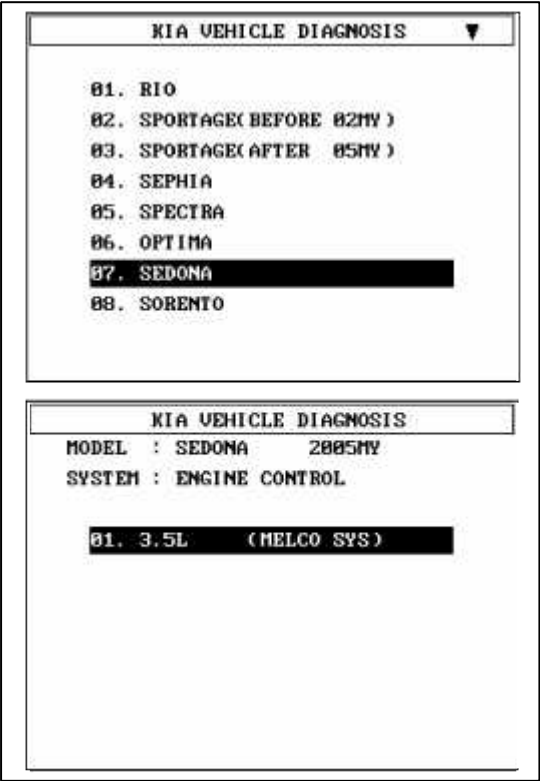
**VIN PROGRAMMING PROCEDURE**

VIN (Vehicle Identification Number) is a number that has the vehicle's information (Maker, Vehicle Type, Vehicle Line/Series, Body Type, Engine Type, Transmission Type, Model Year, Plant Location and so forth. For more information, please refer to the group "GI" in this SERVICE MANUAL). When replacing an ECM, the VIN must be programmed in the ECM. If there is no VIN in ECM memory, the fault code (DTC P0630) is set.

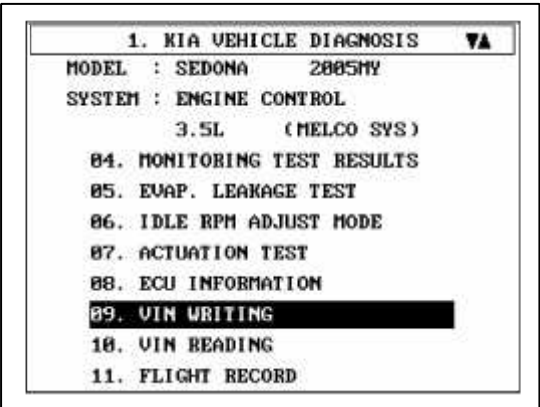
CAUTION

The programmed VIN cannot be changed. When writing the VIN, confirm the VIN carefully

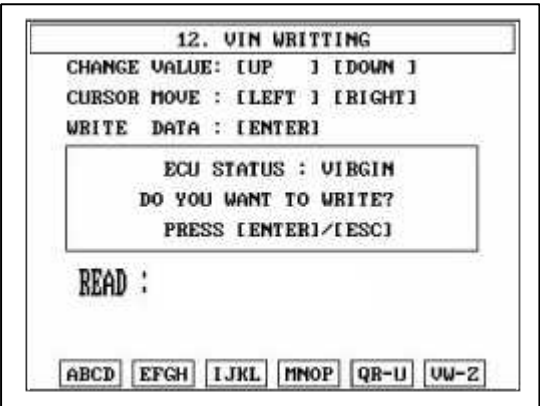
1. Select "Vehicle" and "Engine" (For example, SEDONA 3.5L V6).



2. Select "VIN WRITING".



3. Check the ECM status.



NOTE

- VIRGIN: VIN is not programmed
- LEARNT: VIN has been already programmed

Is the ECM status "VIRGIN"?



**YES**

Go to next step 4.

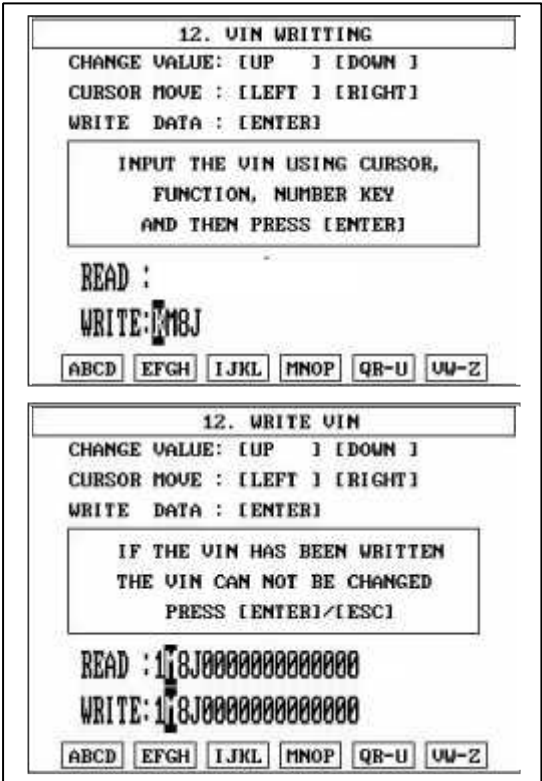
**NO**

END

4. Write the VIN with cursor, function and number keys.

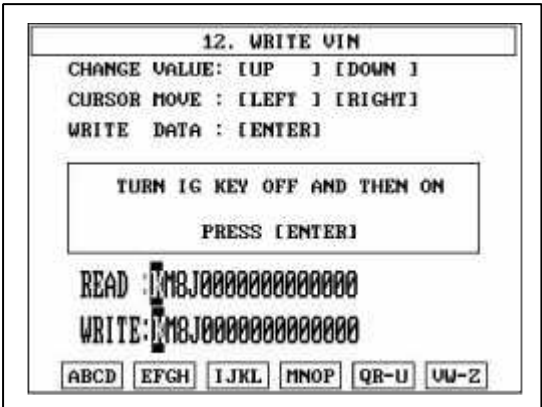
**WARNING**

Before pressing the "ENTER" key, confirm the VIN again because the programmed VIN cannot be changed.



5. After verifying the written VIN, press the "ENTER" key.

6. Turn the ignition switch OFF, then back ON.



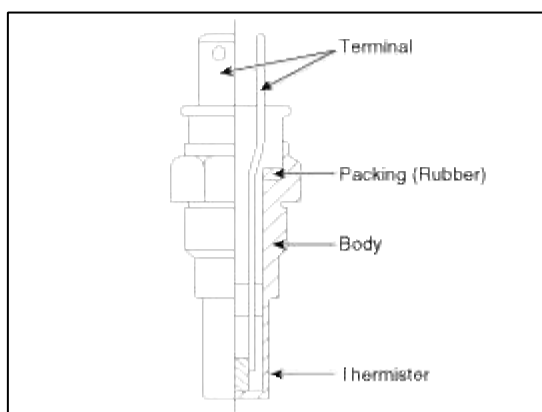
7. Verify the programmed VIN in the ECM memory.

## SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System

### INSPECTION

### FUNCTION AND OPERATION PRINCIPLE

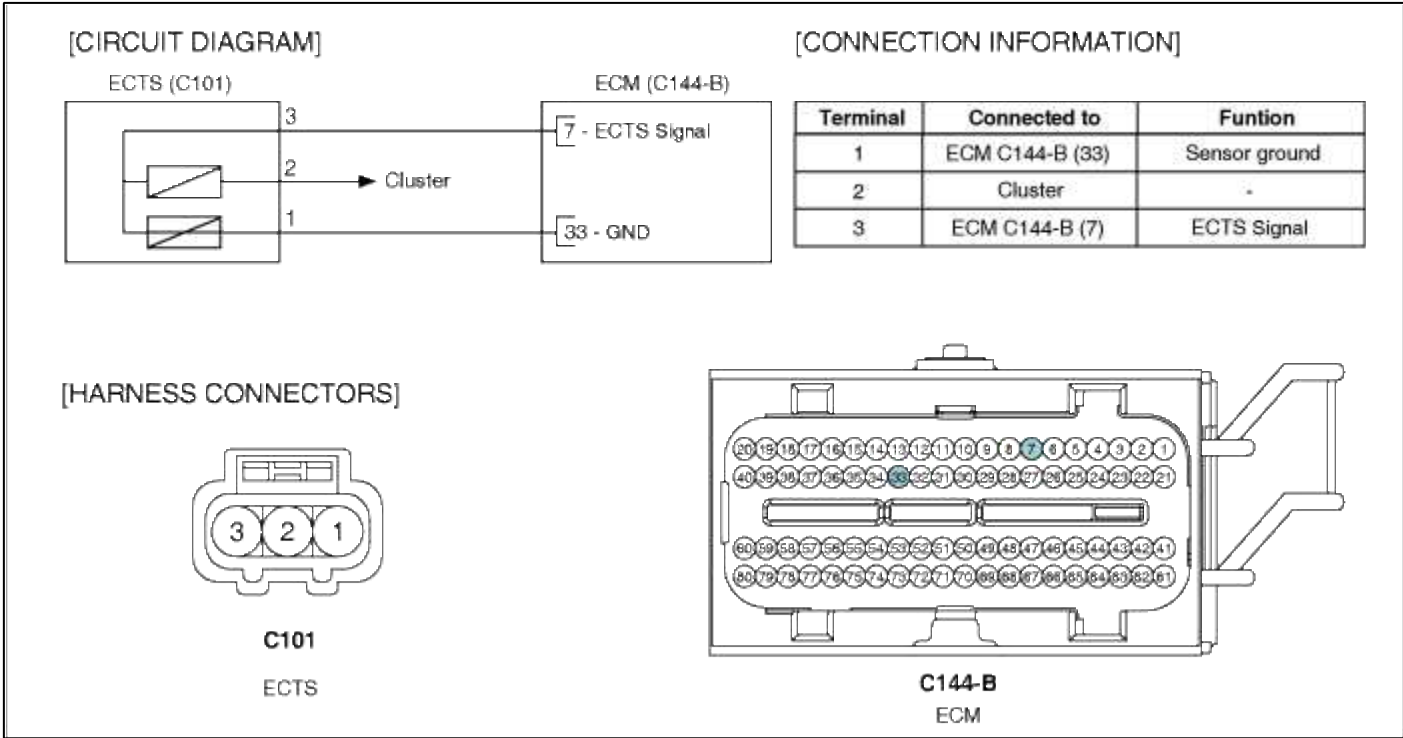
Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the PCM is supplied to the ECTS via a resistor in the PCM. That is, the resistor in the PCM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the PCM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



### SPECIFICATION

Temperature		Resistance(kΩ)
°C	°F	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

### SCHEMATIC DIAGRAM



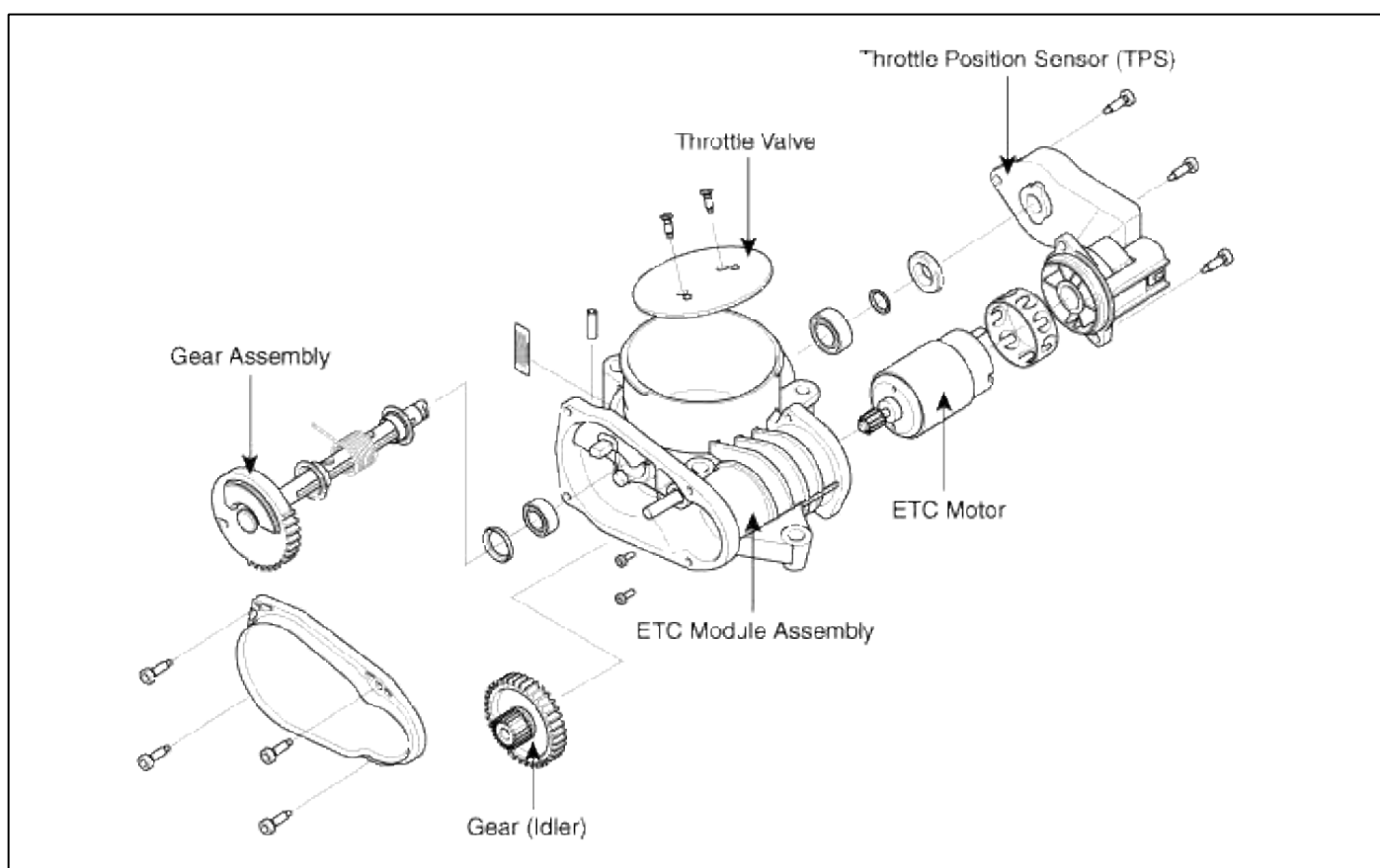
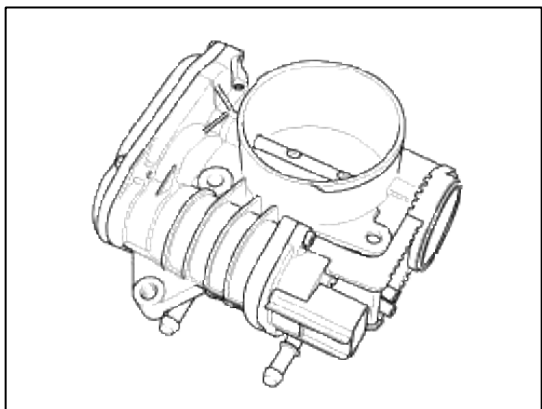
COMPONENT INSPECTION

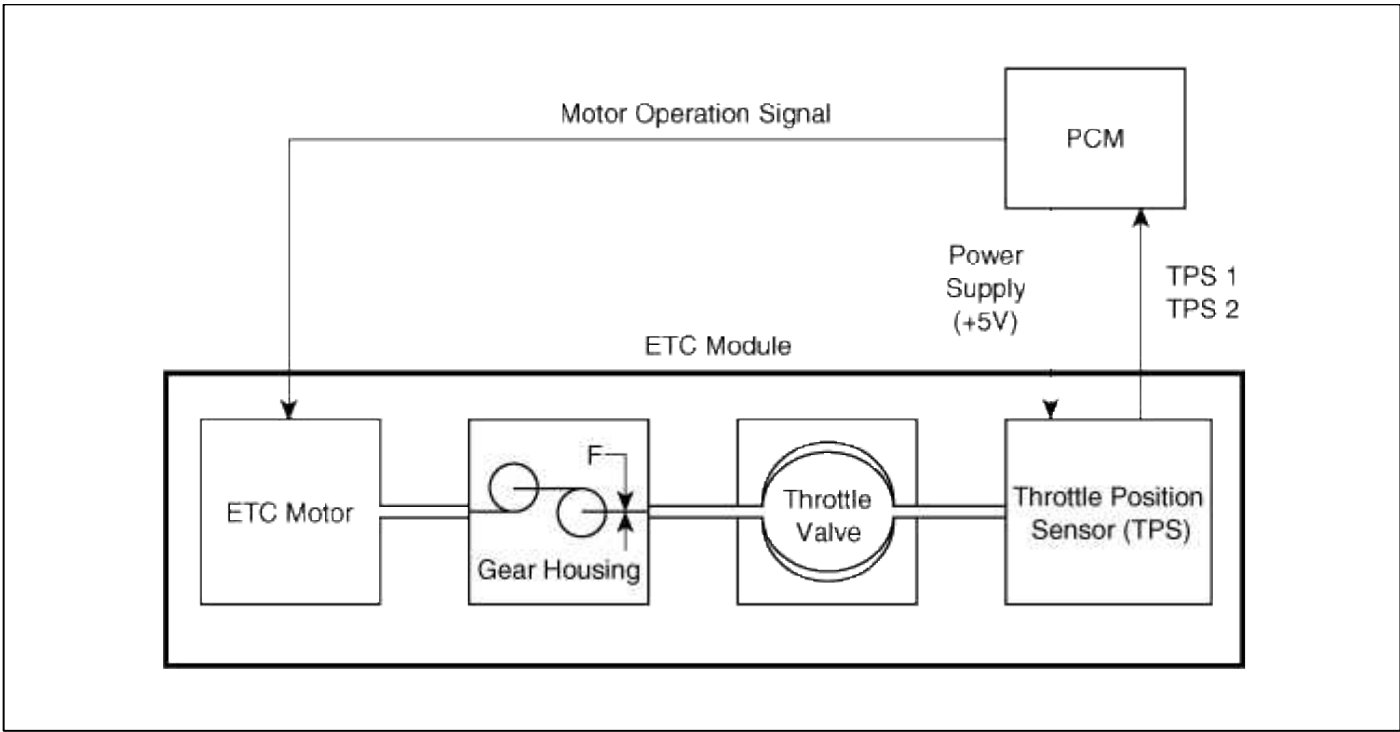
- 1. Turn ignition switch OFF.
- 2. Disconnect ECTS connector.
- 3. Remove the ECTS.
- 4. After immersing the thermistor of the sensor into engine coolant, measure resistance between ECTS terminals 1 and 3.
- 5. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

The Electronic Throttle Control (ETC) System consists of a throttle body with an integrated control motor and throttle position sensor (TPS). Instead of the traditional throttle cable, an Accelerator Position Sensor (APS) is used to receive driver input. The ECM uses the APS signal to calculate the target throttle angle; the position of the throttle is then adjusted via ECM control of the ETC motor. The TPS signal is used to provide feedback regarding throttle position to the ECM. Using ETC, precise control over throttle position is possible; the need for external cruise control modules/cables is eliminated.

**COMPONENTS**

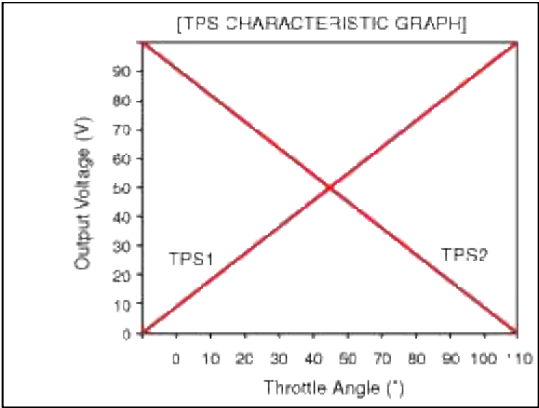


SPECIFICATION

[THROTTLE POSITION SENSOR]

Throttle Angle(°)	Output Voltage(V) [Vref = 5.0V]	
	TPS1	TPS2
0°	0	5.0
10°	0.5	4.5
20°	0.9	4.1
30°	1.4	3.6
40°	1.8	3.2
50°	2.3	2.7
60°	2.7	2.3
70°	3.2	1.8
80°	3.6	1.4
90°	4.1	0.9
100°	4.5	0.5
110°	5.0	0

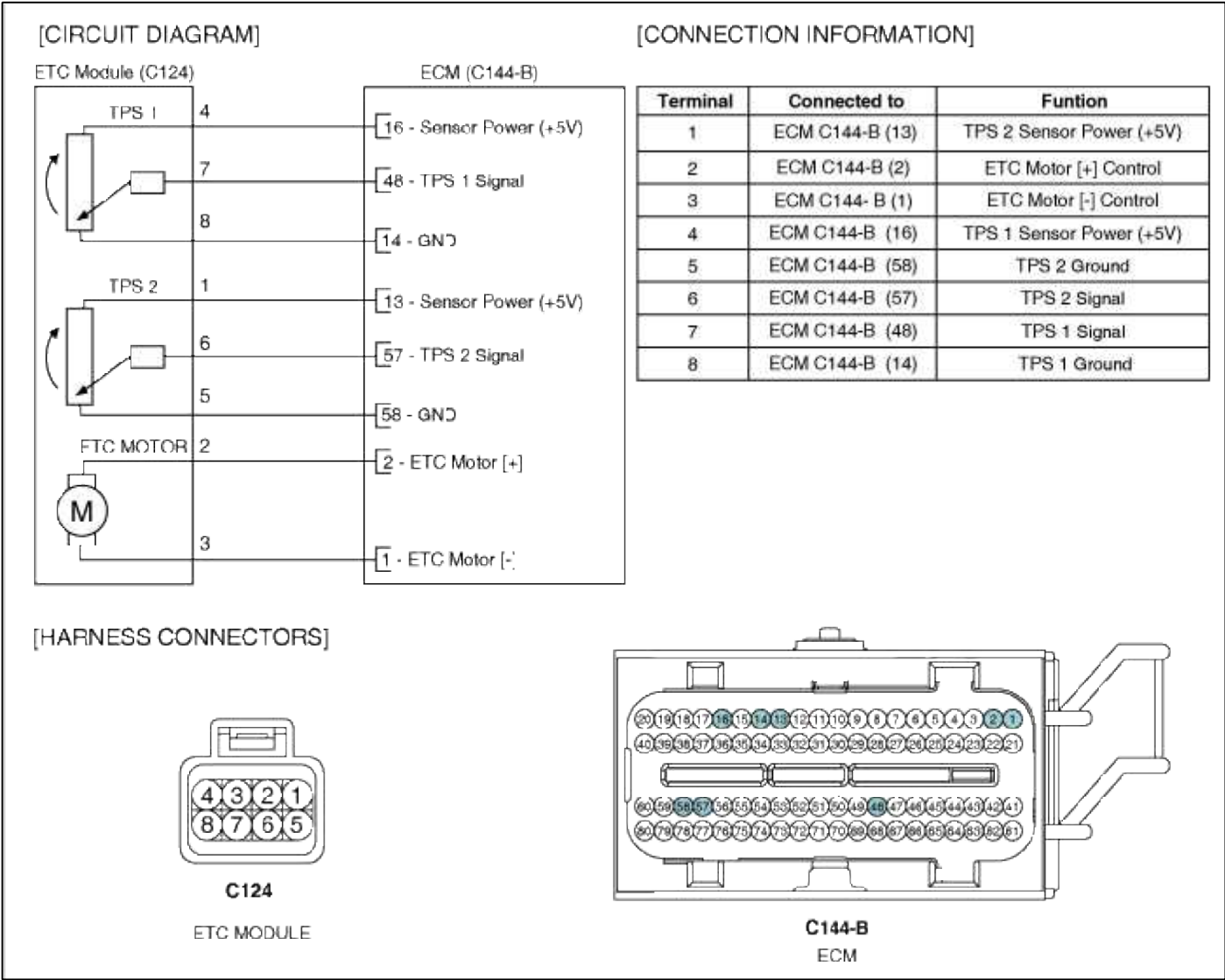
Item	Sensor Resistance
TPS1	4.0 ~ 6.0kΩ at 20°C (68°F)
TPS2	2.72 ~ 4.08kΩ at 20°C (68°F)



[ETC MOTOR]

Item	Sensor Resistance
Coil Resistance (Ω)	1.275 ~ 1.725Ω at 20°C (68°F)

SCHEMATIC DIAGRAM



FAIL-SAFE MODE

Mode	Description	Symptom	Possible Cause
MODE 1	FORCED ENGINE SHUTDOWN	Engine stop	<ul style="list-style-type: none"><li>ETC system can't proceed reliable algorithm procedure<ul style="list-style-type: none"><li>Fatal PCM internal programming error</li><li>Faulty intake system or throttle body</li></ul></li></ul>
MODE 2	FORCED IDLE & POWER MANAGEMENT	Forced idle state controlled by fuel quantity regulation and ignition timing adjustment	<ul style="list-style-type: none"><li>ETC system can't control engine power via throttle device</li><li>Disabled throttle control or broken throttle position information</li></ul>
MODE 3	FORCED IDLE	Forced idle state and no response for accelerator activation	<ul style="list-style-type: none"><li>No information about the accelerator position<ul style="list-style-type: none"><li>Broken APS 1 and 2, faulty A/D converter or internal controller</li></ul></li></ul>
MODE 4	LIMIT PERFORMANCE & POWER MANAGEMENT	Engine power is determined by accelerator position and idle power requirement (Limited vehicle running)	<ul style="list-style-type: none"><li>ETC system can't securely control engine power</li></ul>
MODE 5	LIMIT PERFORMANCE	<ol style="list-style-type: none"><li>Engine power varies with accelerator position, but driver perceives lack of engine power.</li><li>MIL ON (Normal vehicle running)</li></ol>	<ul style="list-style-type: none"><li>Not reliable accelerator position signal or bad maximum power generation<ul style="list-style-type: none"><li>Faulty APS, ignition voltage or internal controller</li></ul></li></ul>
MODE 6	NORMAL	Normal	

COMPONENT INSPECTION  
THROTTLE POSITION SENSOR (TPS)

- Connect a scantool on the Data Link Connector (DLC).
- Start engine and check output voltages of TPS 1 and 2 at C.T and W.O.T.

Specification: Refer to SPECIFICATION.

- Turn ignition switch OFF and disconnect the scantool from the DLC.
- Disconnect ETC module connector and measure resistance between ETC module terminals 4 and 8 (TPS 1).
- Measure resistance between ETC module terminals 1 and 5 (TPS 2).

Specification: Refer to SPECIFICATION.

ETC MOTOR

- Disconnect ETC module connector and measure resistance between ETC module terminals 2 and 3.

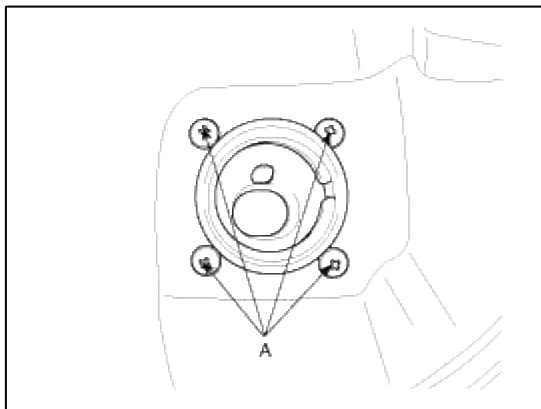
Specification: Refer to SPECIFICATION.

ETC SYSTEM INITIALIZATION

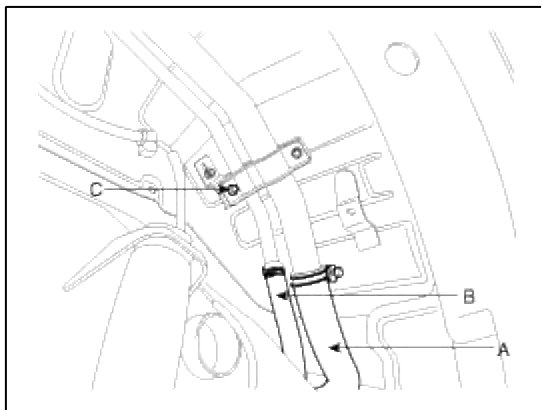
- Erase the trouble codes on ECM
- Turn the ignition key off and keep this condition until the main relay is turned off.(10 sec.)
- Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****REMOVAL**

1. Remove the RH-rear inner wheel house.
2. Open the fuel filler door and unfasten the filler-neck assembly mounting screws (A).



3. Disconnect the fuel filler hose (A) the vacuum hose (B) connected with the canister air filter.



4. Remove the fuel filler neck assembly mounting bolt (C) and remove the fuel filler neck assembly.

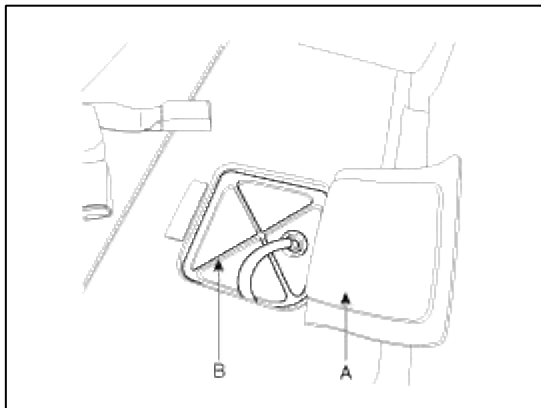
**INSTALLATION**

1. Install the filler-neck assembly in according to the reverse order of "REMOVE" procedure.

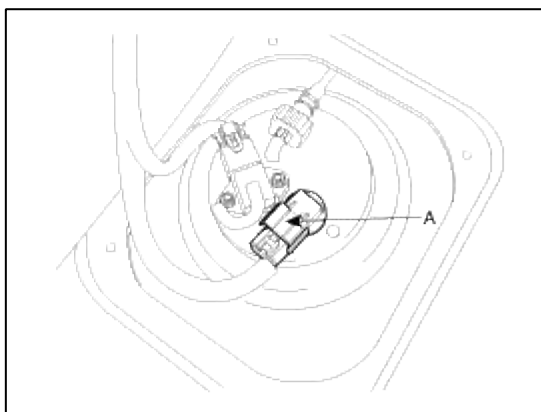


**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR)****1. Preparation**

- (1) Fold the rear seat cushion. (Refer to "SEAT" in BD group)
- (2) Open the carpet (A)

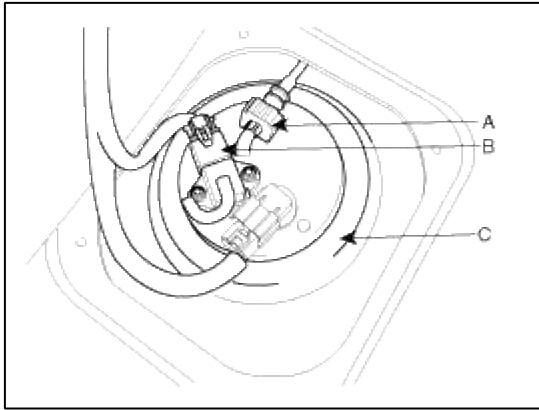


- (3) Remove the service cover (B).
- (4) Disconnect the fuel pump connector (A).



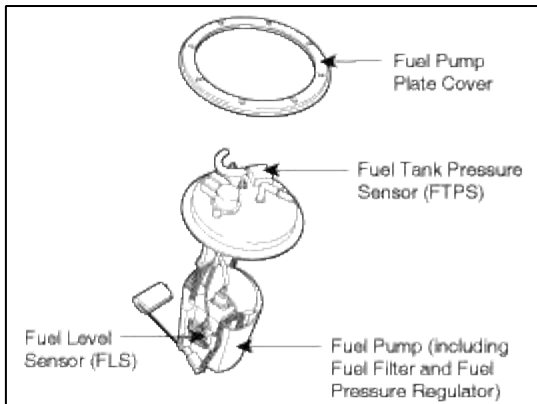
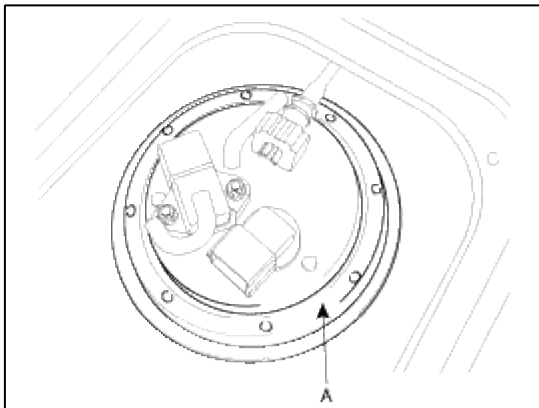
- (5) Start the engine and wait until fuel in fuel line is exhausted.
- (6) After engine stops, turn the ignition switch off.

2. Disconnect the fuel feed quick-connector (A) and the fuel tank pressure sensor connector(B).



3. Remove the rubber cover(C).

4. Unscrew the fuel pump plate cover (A) with the special service tool (SST NO. : 09310-2B200) and remove the fuel pump assembly.



## INSTALLATION

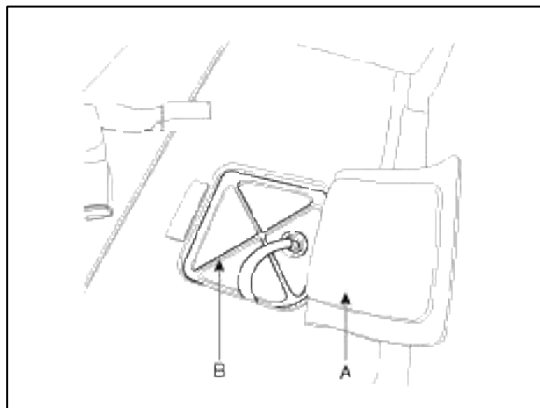
Install the fuel pump in according to the reverse order of "REMOVAL" procedure.

### Tightening torque

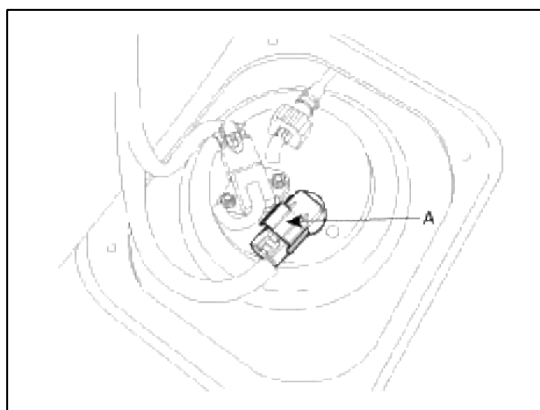
: 78.5 ~ 98.1 N·m (8.0 ~ 10.0 kgf·m, 57.9 ~ 72.4 lbf·ft)

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****REMOVAL****1. Preparation**

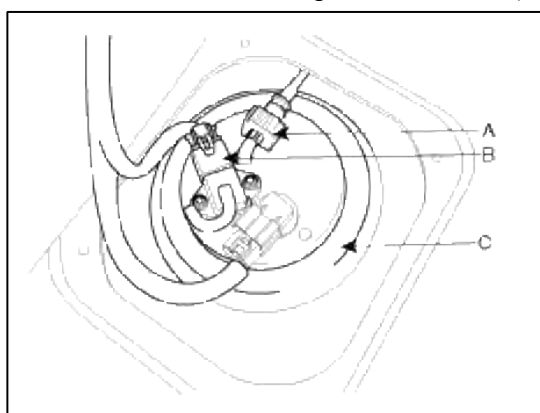
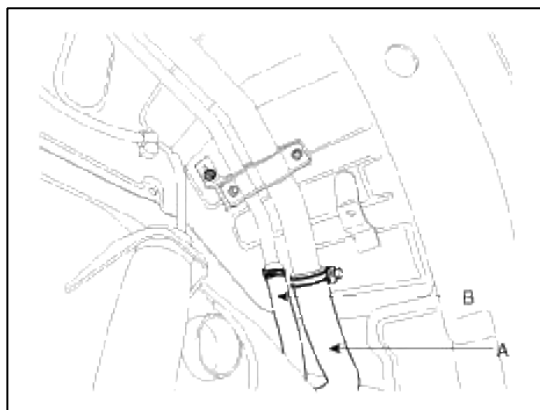
- (1) Fold the rear seat cushion. (Refer to "SEAT" in BD group)
- (2) Open the carpet (A)



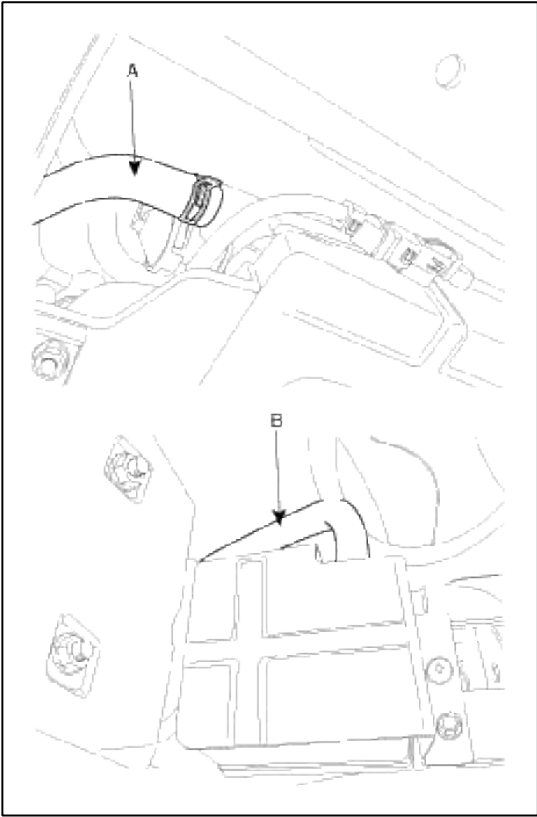
- (3) Remove the service cover (B).
- (4) Disconnect the fuel pump connector (A).



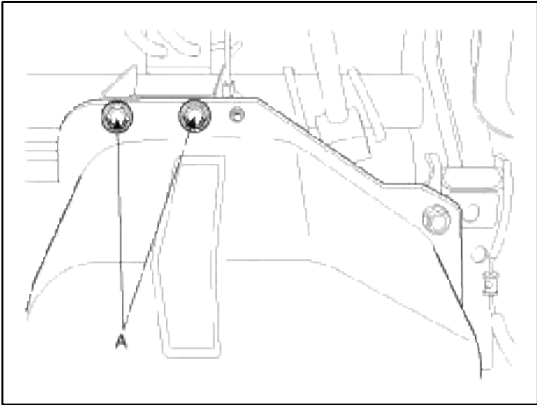
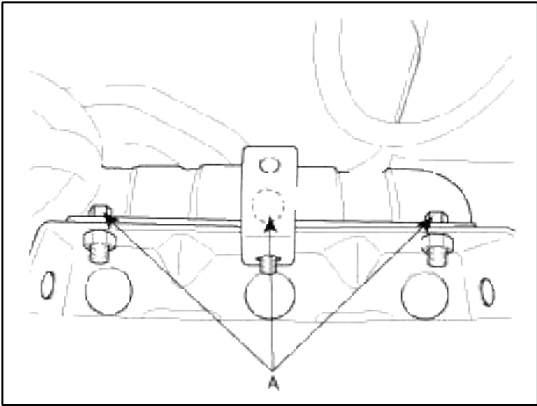
- (5) Start the engine and wait until fuel in fuel line is exhausted.
- (6) After engine stops, turn the ignition switch off.

**2. Disconnect the fuel feed quick-connector (A) and the fuel tank pressure sensor connector(B).****3. Remove the RH-rear inner wheel house.****4. Disconnect the fuel filler hose (A) and the vacuum hose (B) connected with the canister air filter.****5. Lift the vehicle and support the fuel tank with a jack.**

6. Disconnect the vacuum hoses (A,B) from the canister.



7. Remove the fuel tank mounting bolts (A) and remove the fuel tank from the vehicle.



## INSTALLATION

1. Install the fuel tank in according to the reverse order of "REMOVAL" procedure.

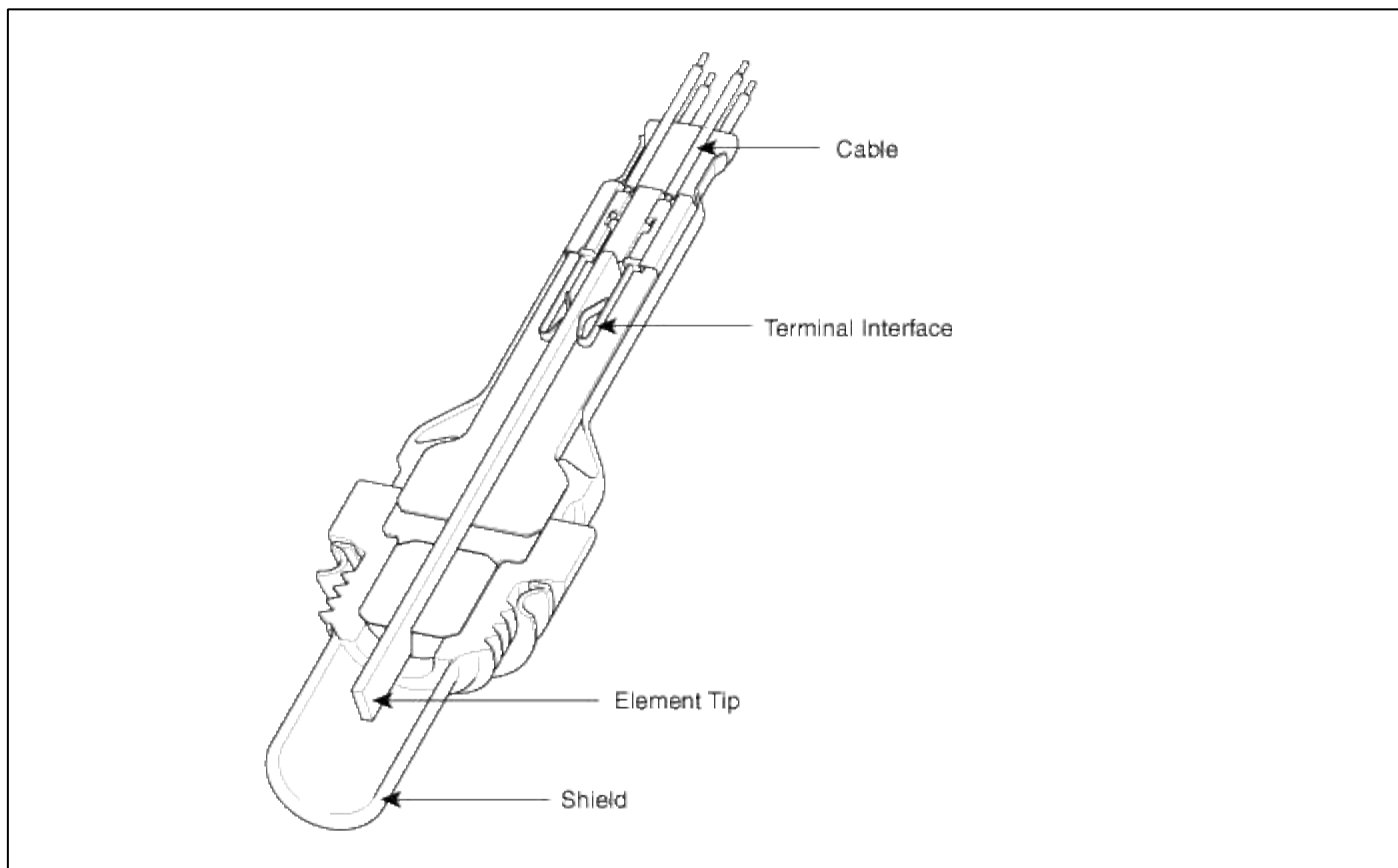
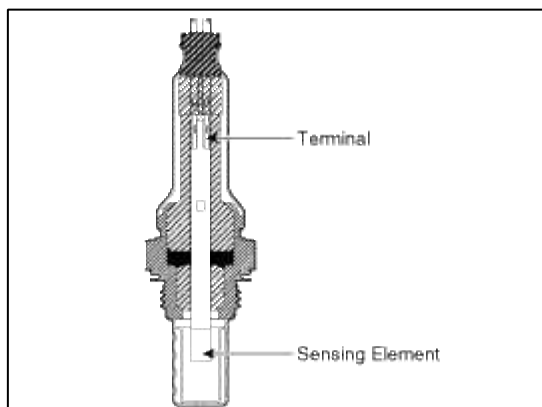
---

Fuel tank installation bolts : 49.1 ~ 58.9N·m (5.0 ~ 6.0 kgf·m, 36.2 ~ 43.4 lbf·ft)

---

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalyst Converter (MCC). After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the oxygen consistency of the exhaust gas to the PCM. When A/F ratio is rich or lean, it generates approximately 1V or 0V respectively. In order that this sensor normally operates, the temperature of the sensor tip is higher than 370°C (698°F). So it has a heater which is controlled by the PCM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.

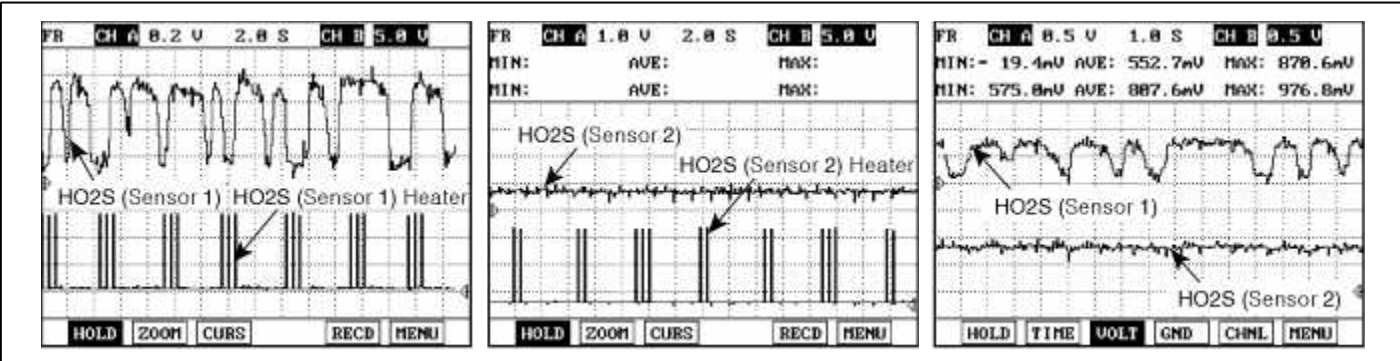


SPECIFICATION

A/F Ratio	Output Voltage (V)
RICH	0.75 ~ 1.0V
LEAN	0 ~ 0.12V

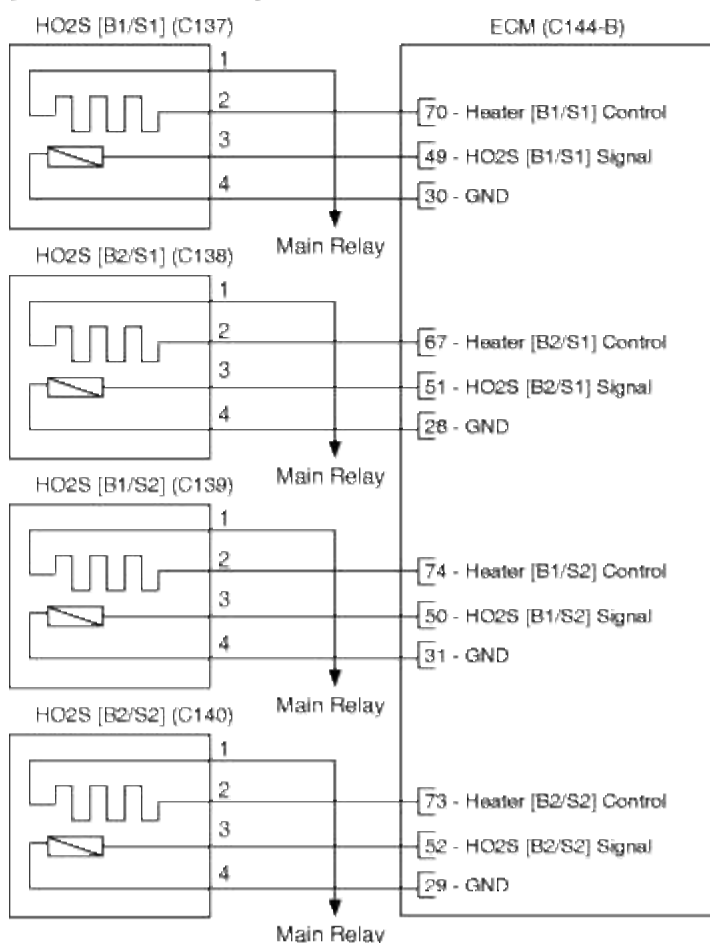
Item	Specification
Heater Resistance (Ω)	8.1 ~ 11.1Ω at 21°C (69.8°F)

WAVEFORM



SCHEMATIC DIAGRAM

## [CIRCUIT DIAGRAM]



## [CONNECTION INFORMATION]

## HO2S [B1/S1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	ECM C144-B (70)	Heater [B1/S1] Control
3	ECM C144-B (49)	HO2S [B1/S1] Signal
4	ECM C144-B (30)	Sensor ground

## HO2S [B2/S1]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	ECM C144-B (67)	Heater [B2/S1] Control
3	ECM C144-B (51)	HO2S [B2/S1] Signal
4	ECM C144-B (28)	Sensor ground

## HO2S [B1/S2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	ECM C144-B (74)	Heater [B1/S2] Control
3	ECM C144-B (50)	HO2S [B1/S2] Signal
4	ECM C144-B (31)	Sensor ground

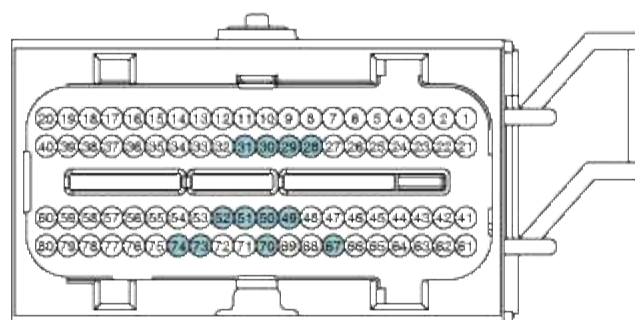
## HO2S [B2/S2]

Terminal	Connected to	Funtion
1	Main Relay	Battery Voltage (B+)
2	ECM C144-B (73)	Heater [B2/S2] Control
3	ECM C144-B (52)	HO2S [B2/S2] Signal
4	ECM C144-B (29)	Sensor ground

## [HARNESS CONNECTORS]

**C137,C138,C139,C140**

HO2S [Bank 1/Sensor 1]  
 HO2S [Bank 2/Sensor 1]  
 HO2S [Bank 1/Sensor 2]  
 HO2S [Bank 2/Sensor 2]

**C144-B**  
ECM

## COMPONENT INSPECTION

1. Check signal waveform of HO2S using a scantool.

Specification: Refer to "waveform".

2. Disconnet the HO2S connector.

3. Measure resistance between HO2S heater terminals 3 and 4.
4. Check that the resistance is within the specification.

---

Specification: Refer to SPECIFICATION.

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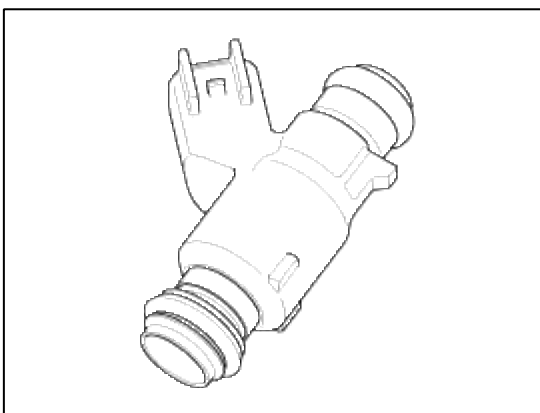


**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

Based on information from various sensors, the PCM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time that the fuel injector is held open. The PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak for a moment.

**CAUTION**

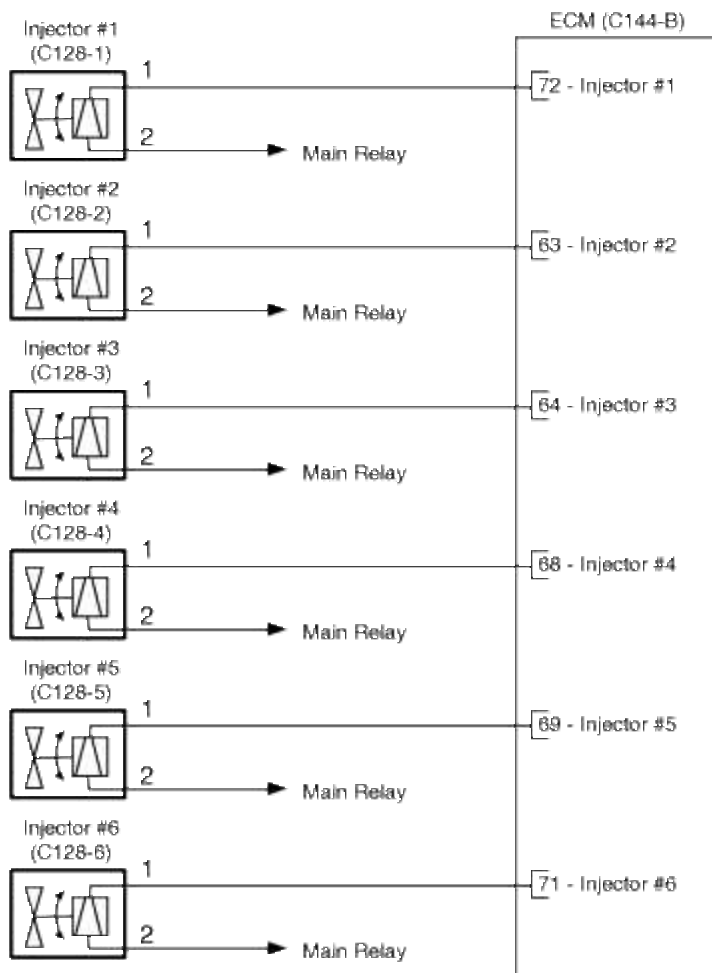
If an injector connector is disconnected for more than 46 seconds while the engine runs, the PCM will determine that the cylinder is misfiring and cut fuel supply. So be careful not to exceed 46 seconds. But the engine runs normally in 10 seconds after turning the ignition key off.

**SPECIFICATION**

Item	Specification
Coil Resistance ( $\Omega$ )	11.4 ~ 12.6 $\Omega$ at 20°C (68°F)

**SCHEMATIC DIAGRAM**

## [CIRCUIT DIAGRAM]



## [CONNECTION INFORMATION]

## Injector #1

Terminal	Connected to	Funtion
1	ECM C144-B (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

## Injector #2

Terminal	Connected to	Funtion
1	ECM C144-B (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

## Injector #3

Terminal	Connected to	Funtion
1	ECM C144-B (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

## Injector #4

Terminal	Connected to	Funtion
1	ECM C144-B (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

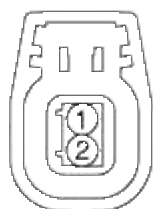
## Injector #5

Terminal	Connected to	Funtion
1	ECM C144-B (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

## Injector #6

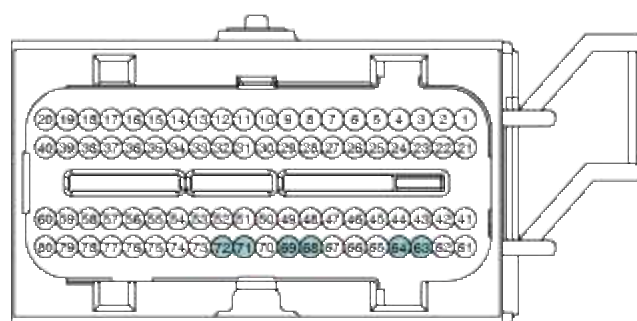
Terminal	Connected to	Funtion
1	ECM C144-B (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

## [HARNESS CONNECTORS]



C128-1,2,3,4,5,6

Injector #1,2,3,4,5,6



C144-B

ECM

## COMPONENT INSPECTION

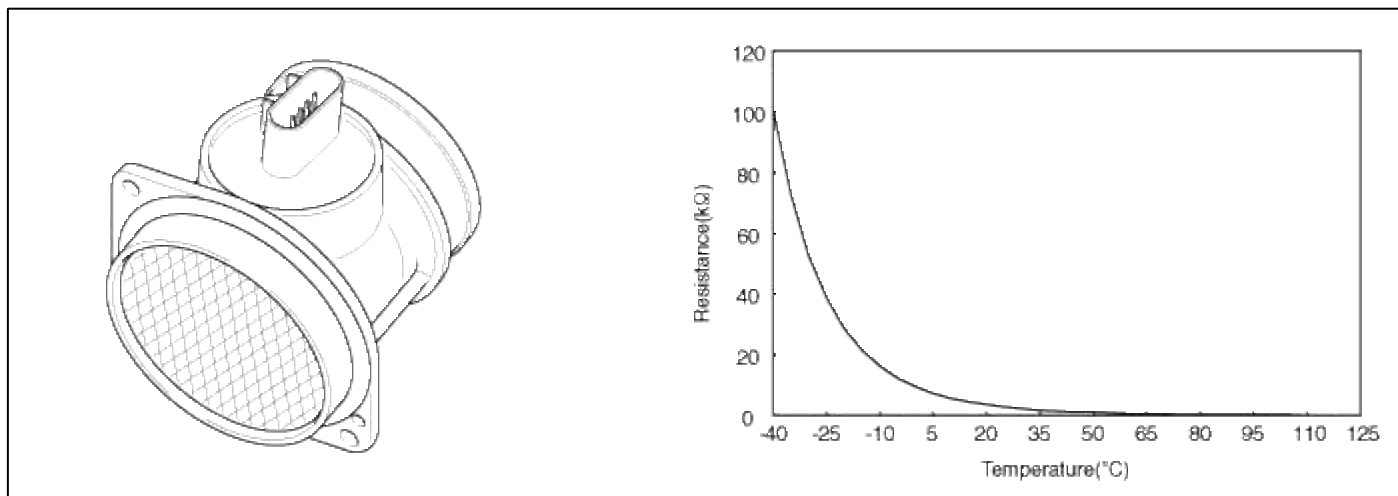
1. Turn ignition switch OFF.
2. Disconnect injector connector.
3. Measure resistance between injector terminals 1 and 2.

4. Check that the resistance is within the specification.

---

Specification: Refer to SPECIFICATION.

---

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

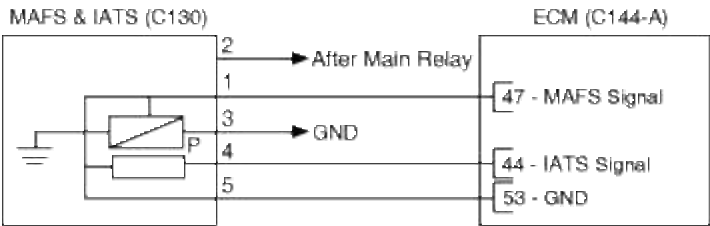
Intake Air Temperature Sensor (IATS) is installed inside the Mass Air Flow Sensor (MAFS) and detects the intake air temperature. To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the PCM uses not only MAFS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature.

**SPECIFICATION**

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	100.87
-20	-4	28.58
0	32	9.40
10	50	5.66
20	68	3.51
40	104	1.47
60	140	0.67
80	176	0.33

**SCHEMATIC DIAGRAM**

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

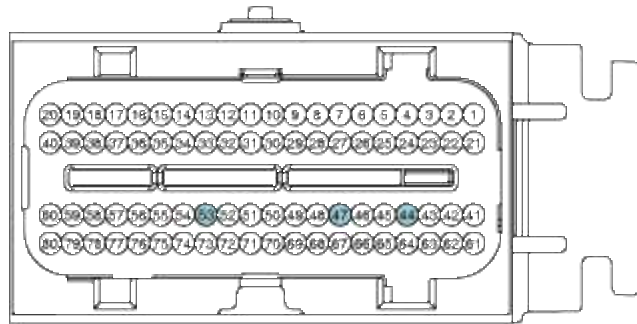
Terminal	Connected to	Function
1	ECM C144-A (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	ECM C144-A (44)	IATS Signal
5	ECM C144-A (53)	Sensor Ground

[HARNESS CONNECTORS]



**C130**

MAFS & IATS



**C144-A**

ECM

COMPONENT INSPECTION

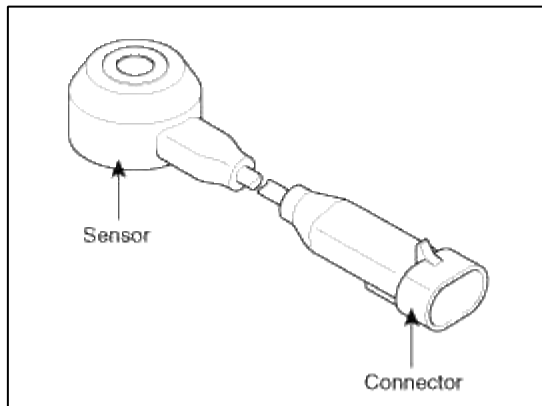
1. Turn ignition switch OFF.
2. Disconnect IATS connector.
3. Measure resistance between IATS terminals 4 and 5.
4. Check that the resistance is within the specification.

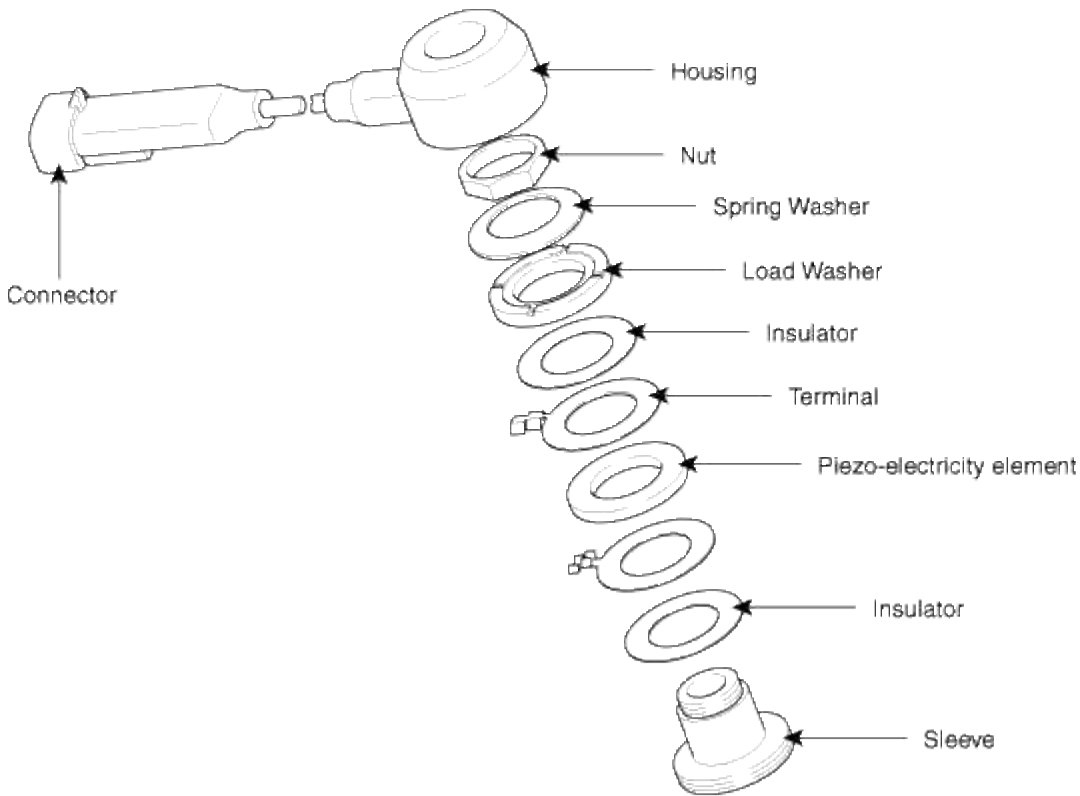
Specification: Refer to SPECIFICATION.

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) senses engine knocking and the two sensors are installed inside the V-valley of the cylinder block.

When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. At this time, this sensor transfers the voltage signal higher than the specified value to the PCM and the PCM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the PCM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.



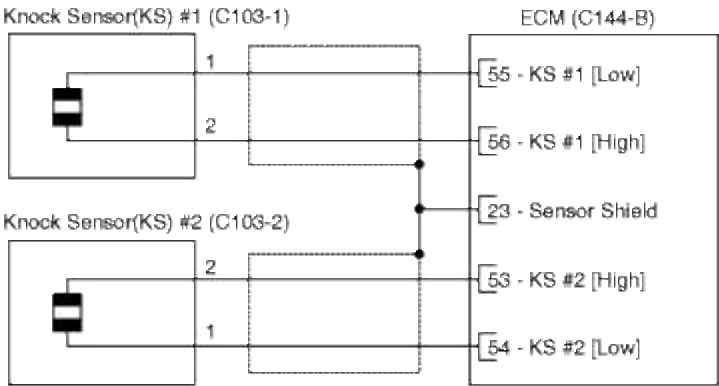


SPECIFICATION

Item	Specification
Capacitance (pF)	1,480 ~ 2,220pF

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

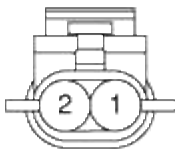
KS #1 (Cyl. #4,5,6)

Terminal	Connected to	Funtion
1	ECM C144-B (55)	KS #1 [Low] signal
2	ECM C144-B (56)	KS #1 [High] signal

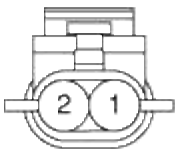
KS #2 (Cyl. #1,2,3)

Terminal	Connected to	Funtion
1	ECM C144-B (54)	KS #2 [Low] signal
2	ECM C144-B (53)	KS #2 [High] signal

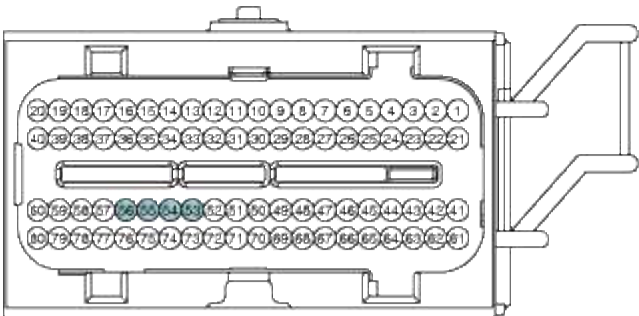
[HARNESS CONNECTORS]



**C103-1**  
KS #1

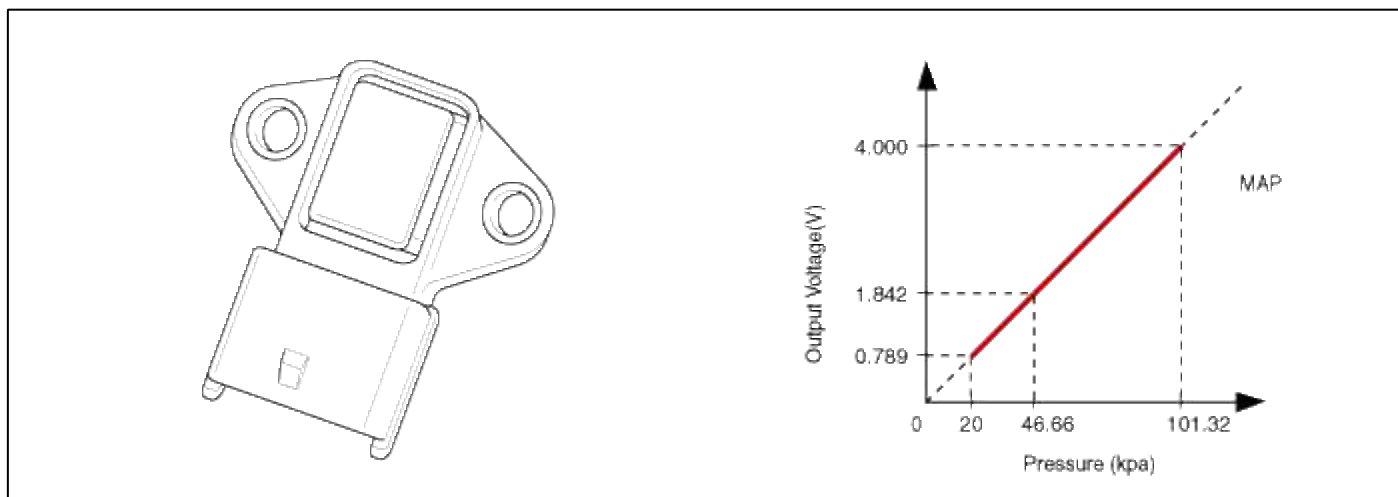


**C103-2**  
KS #2



**C144-B**  
ECM



**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

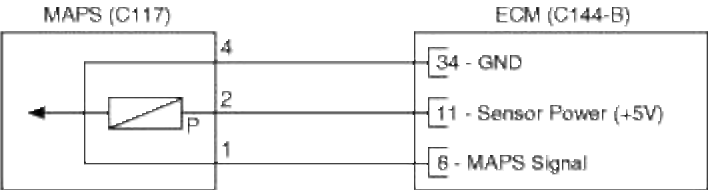
Manifold Absolute Pressure Sensor (MAPS) is speed-density type sensor and is installed on the surge tank. This MAPS senses absolute pressure in surge tank and transfers this analog signal proportional to the pressure to the PCM. The PCM calculates the intake air quantity and engine speed based on this signal. This MAPS consists of piezo-electric element and hybrid IC that amplifies the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. 100% vacuum and the manifold pressure applies to both sides of it respectively. That is, this sensor outputs the silicon variation proportional to pressure change by voltage.

**SPECIFICATION**

Pressure(kPa)	Output Voltage (V)
20.0kPa	0.79
46.66kPa	1.84
101.32kPa	4.0

**SCHEMATIC DIAGRAM**

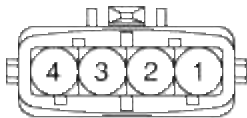
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

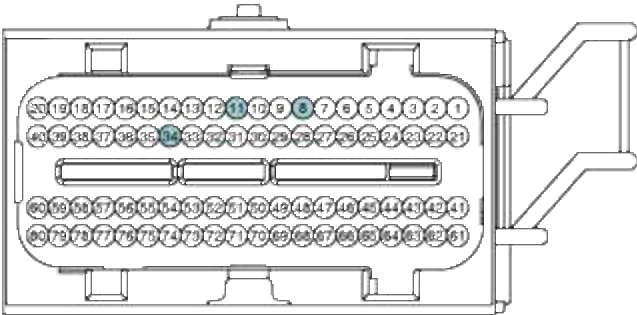
Terminal	Connected to	Funtion
1	ECM C144-B (8)	MAPS Signal
2	ECM C144-B (11)	Sensor Power (+5V)
3	-	-
4	ECM C144-B (34)	Sensor ground

[HARNESS CONNECTORS]



C117

MAPS



C144-B

ECM

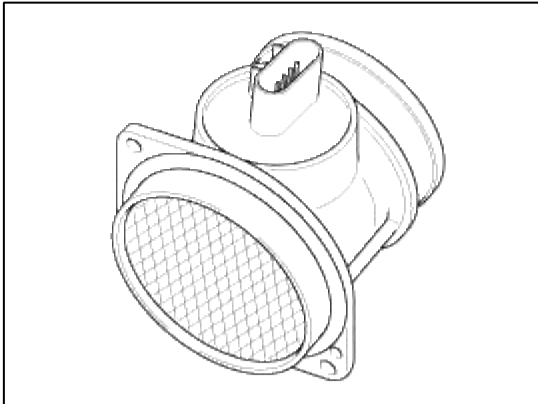
COMPONENT INSPECTION

1. Connect a scantool on Diagnosis Link Connector (DLC).
2. Check MAPS output voltage at idle and IG ON.

Condition	Output Voltage (V)
IG ON	3.9 ~ 4.1V
Idle	0.8 ~ 1.6V

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION****FUNCTION AND OPERATION PRINCIPLE**

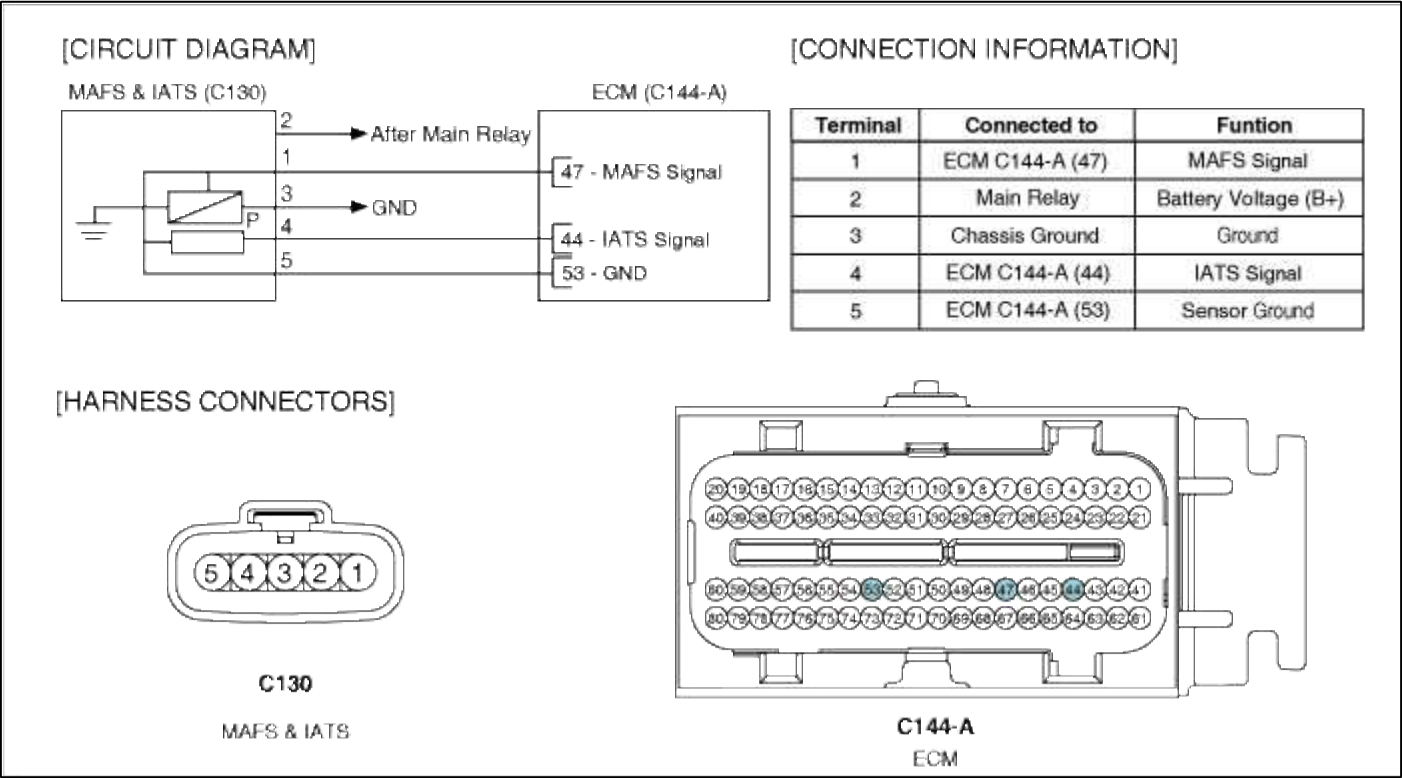
Mass Air Flow Sensor (MAFS) is a hot-film type sensor and is located in between the air cleaner and the throttle body. It consists of a tube, a sensor assembly and honey cell and detects intake air quantity flowing into the intake manifold. While the intake air coming out of the air cleaner flows by the honey cell, it becomes laminar flow, and then it passes the hot-film. At this time, heat transfer is generated by convection and this sensor loses its energy. This sensor detects the mass air flow by using the energy loss and transfers the information to the PCM by frequency. The PCM calculates fuel quantity and ignition timing.

**SPECIFICATION**

<b>Air Flow (kg/h)</b>	<b>Output Frequency (Hz)</b>
12.6	2,617
18.0	2,958
23.4	3,241
32.4	3,653
43.2	4,024
57.6	4,399
72.0	4,704
108.0	5,329
144.0	5,897
198.0	6,553
270.0	7,240
360.0	7,957
486.0	8,738

666.0	9,644
900.0	10,590

SCHEMATIC DIAGRAM



COMPONENT INSPECTION

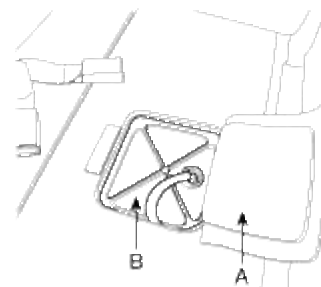
1. Check the MAFS visually.
  - A. Mounting direction correct.
  - B. Any contamination, corrosion or damage on connector.
  - C. Air cleaner's clogging or wet.
  - D. MAFS cylinder's deforming or blocking by any foreign material.
2. Check any leakage on intake system and intercooler system.

**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System**

**FUEL PRESSURE TEST**

## 1. PREPARING

1. Fold the rear seat cushion (Refer to "SEAT" in BD group.)
2. Open the carpet (A) and remove the service cover (B).



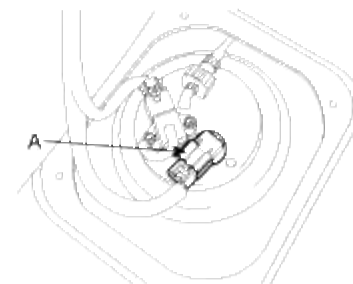
## 2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.



### NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



## 3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

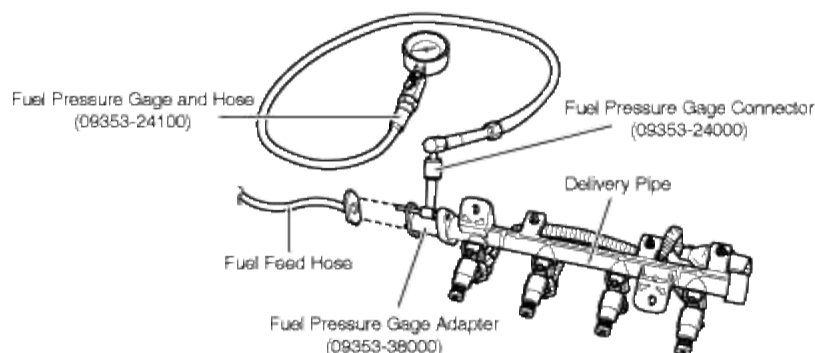
1. Disconnect the fuel feed hose from the delivery pipe.



### CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gage Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gage Connector (09353-24000) to the Fuel Pressure Gage Adapter (09353-38000).
4. Connect the Fuel Pressure Gage and Hose (09353-24100) to Fuel Pressure Gage Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gage Adapter (09353-38000).



#### 4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

#### 5. FUEL PRESURE TEST

1. Disconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

---

Standard Value: 375 ~ 385 kpa (3.82 ~ 3.92 kgf/cm<sup>2</sup>, 54.3 ~ 55.8 psi)

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- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

---

After engine stops, the gage reading should hold for about 5 minutes

---

- Observing the declination of the fuel pressure when the gage reading drops and perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

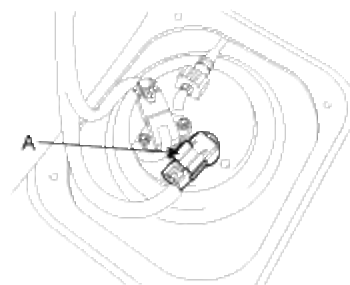
## 6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.



### NOTE

*Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.*



## 7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.



### CAUTION

*Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.*

5. Connect the fuel feed hose to the delivery pipe.

## 8. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.



**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System****INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)**

<b>DTC</b>	<b>Description</b>	<b>MIL</b>	<b>Page</b>
P0011	A Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)	●	
P0012	A Camshaft Position-Timing Over-Retarded (Bank 1)	●	
P0016	Crankshaft Position-Camshaft Position Correlation (Bank 1 Sensor A)	●	
P0018	Crankshaft Position-Camshaft Position Correlation (Bank 2 Sensor A)	●	
P0021	A Camshaft Position-Timing Over-Advanced or System Performance (Bank 2)	●	
P0022	A Camshaft Position-Timing Over-Retarded (Bank 2)	●	
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	●	
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	●	
P0030	HO2S Heater Control Circuit (Bank 1 / Sensor 1)	●	
P0031	HO2S Heater Circuit Low (Bank 1 / Sensor 1)	●	
P0032	HO2S Heater Circuit High (Bank 1 / Sensor 1)	●	
P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)	●	
P0037	HO2S Heater Circuit Low (Bank 1 / Sensor 2)	●	
P0038	HO2S Heater Circuit High (Bank 1 / Sensor 2)	●	
P0050	HO2S Heater Control Circuit (Bank 2 / Sensor 1)	●	
P0051	HO2S Heater Circuit Low (Bank 2 / Sensor 1)	●	
P0052	HO2S Heater Circuit High (Bank 2 / Sensor 1)	●	
P0056	HO2S Heater Control Circuit (Bank 2 / Sensor 2)	●	
P0057	HO2S Heater Circuit Low (Bank 2 / Sensor 2)	●	
P0058	HO2S Heater Circuit High (Bank 2 / Sensor 2)	●	
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	●	
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	●	
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	●	
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	●	
P0101	Mass or Volume Air Flow Circuit Range/Performance	●	
P0102	Mass or Volume Air Flow Circuit Low Input	●	
P0103	Mass or Volume Air Flow Circuit High Input	●	
P0105	Manifold Absolute Pressure/Barometric Pressure Circuit	●	
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	●	
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●	
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●	
P0110	Intake Air Temperature Sensor1 Circuit	●	
P0111	Intake Air Temperature Sensor1 Circuit Range/Performance	●	

P0112	Intake Air Temperature Sensor1 Circuit Low Input	●	
P0113	Intake Air Temperature Sensor1 Circuit High Input	●	
P0115	Engine Coolant Temperature Circuit	●	
P0116	Engine Coolant Temperature Circuit Range/Performance	●	
P0117	Engine Coolant Temperature Circuit Low Input	●	
P0118	Engine Coolant Temperature Circuit High Input	●	
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	●	
P0128	Coolant Thermostat (Coolant Temperature below Thermostat Regulating Temperature)	●	
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●	
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	●	
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●	
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●	
P0139	HO2S Circuit Slow Response (Bank 1 / Sensor 2)	●	
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	●	
P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)	●	
P0152	HO2S Circuit High Voltage (Bank 2 / Sensor 1)	●	
P0153	HO2S Circuit Slow Response (Bank 2 / Sensor 1)	●	
P0154	HO2S Circuit No Activity Detected (Bank 2 / Sensor 1)	●	
P0157	HO2S Circuit Low Voltage (Bank 2 / Sensor 2)	●	
P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)	●	
P0159	HO2S Circuit Slow Response (Bank 2 / Sensor 2)	●	
P0160	HO2S Circuit No Activity Detected (Bank 2 / Sensor 2)	●	
P0171	System Too Lean (Bank 1)	●	
P0172	System Too Rich (Bank 1)	●	
P0174	System Too Lean (Bank 2)	●	
P0175	System Too Rich (Bank 2)	●	
P0196	Engine Oil Temperature Sensor Range / Performance	●	
P0197	Engine Oil Temperature Sensor Low Input	●	
P0198	Engine Oil Temperature Sensor High Input	●	
P0217	Engine Coolant Over Temperature Condition	●	
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low Input	●	
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High Input	●	

P0230	Fuel Pump Primary Circuit	▲	
P0261	Cylinder 1-Injector Circuit Low	●	
P0262	Cylinder 1-Injector Circuit High	●	
P0264	Cylinder 2-Injector Circuit Low	●	
P0265	Cylinder 2-Injector Circuit High	●	
P0267	Cylinder 3-Injector Circuit Low	●	
P0268	Cylinder 3-Injector Circuit High	●	
P0270	Cylinder 4-Injector Circuit Low	●	
P0271	Cylinder 4-Injector Circuit High	●	
P0273	Cylinder 5-Injector Circuit Low	●	
P0274	Cylinder 5-Injector Circuit High	●	
P0276	Cylinder 6-Injector Circuit Low	●	
P0277	Cylinder 6-Injector Circuit High	●	
P0300	Random/Multiple Cylinder Misfire Detected	●	
P0301	Cylinder 1-Misfire Detected	●	
P0302	Cylinder 2-Misfire Detected	●	
P0303	Cylinder 3-Misfire Detected	●	
P0304	Cylinder 4-Misfire Detected	●	
P0305	Cylinder 5-Misfire Detected	●	
P0306	Cylinder 6-Misfire Detected	●	
P0315	Segment Time Acquisition Incorrect	▲	
P0325	Knock Sensor 1 Circuit	▲	
P0326	Knock Sensor 1 Circuit Range/Performance (Bank 1)	▲	
P0330	Knock Sensor 2 Circuit	▲	
P0331	Knock Sensor 2 Circuit Range/Performance (Bank 2)	▲	
P0335	Crankshaft Position Sensor "A" Circuit	●	
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	●	
P0340	Camshaft Position Sensor "A" Circuit Malfunction (Bank 1 or Single Sensor)	●	
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	●	
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	●	
P0351	Ignition Coil "A" Primary / Secondary Circuit	●	
P0352	Ignition Coil "B" Primary / Secondary Circuit	●	
P0353	Ignition Coil "C" Primary / Secondary Circuit	●	
P0354	Ignition Coil "D" Primary / Secondary Circuit	●	
P0355	Ignition Coil "E" Primary / Secondary Circuit	●	
P0356	Ignition Coil "F" Primary / Secondary Circuit	●	

P0420	Catalyst System Efficiency below Threshold (Bank 1)	●	
P0430	Catalyst System Efficiency below Threshold (Bank 2)	●	
P0441	Evap. Emission System Incorrect Purge Flow	●	
P0442	Evap. Emission System-Leak Detected (Small Leak)	●	
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●	
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●	
P0447	Evap. Emission System-Vent Control Circuit Open	●	
P0448	Evap. Emission System-Vent Control Circuit Shorted	●	
P0451	Evap. Emission System-Pressure Sensor Range / Performance	●	
P0452	Evap. Emission System-Pressure Sensor Low Input	●	
P0453	Evap. Emission System-Pressure Sensor High Input	●	
P0454	Evap. Emission System-Pressure Sensor Intermittent	●	
P0455	Evap. Emission System-Leak Detected(Large Leak)	●	
P0456	Evap. Emission System-Leak Detected (Very Small Leak)	●	
P0461	Fuel Level Sensor "A" Circuit Range/Performance	●	
P0462	Fuel Level Sensor "A" Circuit Low Input	●	
P0463	Fuel Level Sensor "A" Circuit High Input	●	
P0464	Fuel Level Sensor "A" Circuit Intermittent	●	
P0480	Fan 1 Control Circuit Malfunction	●	
P0481	Fan 2 Control Circuit Malfunction	●	
P0501	Vehicle Speed Sensor A Range/Performance	●	
P0504	Brake Switch "A"/"B" Correlation	●	
P0506	Idle Air Control System-RPM Lower Than Expected	●	
P0507	Idle Air Control System-RPM Higher Than Expected	●	
P050B	Spark Timing Error	●	
P0532	A/C Refrigerant Pressure Sensor "A" Circuit Low Input	▲	
P0533	A/C Refrigerant Pressure Sensor "A" Circuit High Input	▲	
P0562	System Voltage Low	●	
P0563	System Voltage High	●	
P0571	Brake Switch "A" Circuit	●	
P0601	EEPROM-Check Sum Error	●	
P0602	EEPROM-Programing Error	●	
P0604	Internal Control Module Random Access Memory (RAM) Error	●	
P0606	ECM/PCM Processor(ECM-SELF TEST Failed)	●	
P061B	Internal Control Module Torque Calculation Performance	▲	
P0630	VIN not Programmed or Incompatible-ECM/PCM	●	

P0638	Throttle Actuator Control Range/Performance	●	
P0641	Sensor Reference Voltage "A" Circuit Open	●	
P0646	A/C Clutch Relay Control Circuit Low	▲	
P0647	A/C Clutch Relay Control Circuit High	▲	
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲	
P0651	Sensor Reference Voltage "B" Circuit Open	●	
P0660	Intake Manifold Tuning Valve Control Circuit/Open (Bank 1)	●	
P0685	ECM/PCM Power Relay Control Circuit /Open	▲	
P1106	Manifold Absolute Pressure Sensor Circuit Short - Intermittent High Input	▲	
P1107	Manifold Absolute Pressure Sensor Circuit Short - Intermittent Low Input	▲	
P1111	Intake Air Temperature Sensor Circuit Short - Intermittent High Input	▲	
P1112	Intake Air Temperature Sensor Circuit Short - Intermittent Low Input	▲	
P1114	Engine Coolant Temperature Sensor Circuit Intermittent Low Input	▲	
P1115	Engine Coolant Temperature Sensor Circuit - Intermittent High Input	▲	
P1295	ETC (Electronic Throttle Control) System Malfunction - Power Management	●	
P1523	ETC (Electronic Throttle Control) System Malfunction - Throttle Valve Stuck	▲	
P161B	ECM/PCM Internal Error - Torque Calculation	●	
P2104	ETC (Electronic Throttle Control) System Malfunction - Forced Idle	●	
P2105	ETC (Electronic Throttle Control) System Malfunction - Forced Engine Shutdown	●	
P2106	ETC (Electronic Throttle Control) System Malfunction - Forced Limited Power	●	
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	●	
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	●	
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	●	
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	●	
P2135	Throttle/Pedal Position Sensor/Switch "A" / "B" Voltage Correlation	●	
P2138	Throttle/Pedal Position Sensor/Switch "D" / "E" Voltage Correlation	●	
P2173	ETC (Electronic Throttle Control) System Malfunction - High Air flow Detected	●	
P2187	System Too Lean at Idle (← Additive) (Bank 1)	●	
P2188	System Too Rich at Idle (Bank 1)	●	
P2189	System Too Lean at Idle (← Additive) (Bank 2)	●	
P2190	System Too Rich at Idle (Bank 2)	●	
P2195	HO2S Signal Stuck Lean (Bank 1 / Sensor 1)	●	
P2196	HO2S Signal Stuck Rich (Bank 1 / Sensor 1)	●	
P2197	HO2S Signal Stuck Lean (Bank 2 / Sensor 1)	●	
P2198	HO2S Signal Stuck Rich (Bank 2 / Sensor 1)	●	
P2270	HO2S Signal Stuck Lean (Bank 1 / Sensor 2)	●	

P2271	HO2S Signal Stuck Rich (Bank 1 / Sensor 2)	●	
P2272	HO2S Signal Stuck Lean (Bank 2 / Sensor 2)	●	
P2273	HO2S Signal Stuck Rich (Bank 2 / Sensor 2)	●	
P2422	Evap. Emission System-Canister Clogging	●	
P2507	ECM/PCM Power Input Signal Low	●	
P2610	ECM/PCM Internal Engine Off Timer Performance	●	
P2A00	HO2S Not Ready (Bank 1 / Sensor 1)	●	
P2A01	HO2S Circuit Range/Performance (Bank 1 / Sensor 2)	●	
P2A03	HO2S Not Ready (Bank 2 / Sensor 1)	●	
P2A04	HO2S Circuit Range/Performance (Bank 2 / Sensor 2)	●	
U0001	CAN Communication Malfunction	●	
U0101	Serial Communication Problem with TCU (Timeout)	●	

## NOTE

- : MIL ON & MEMORY
- ▲ : MIL OFF & MEMORY

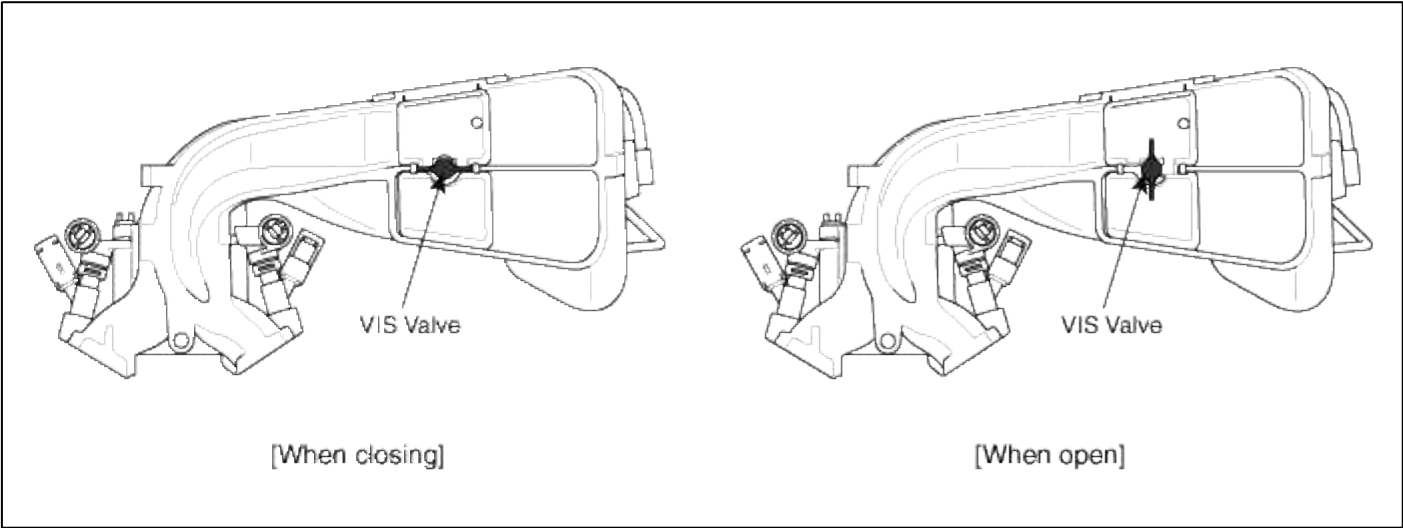
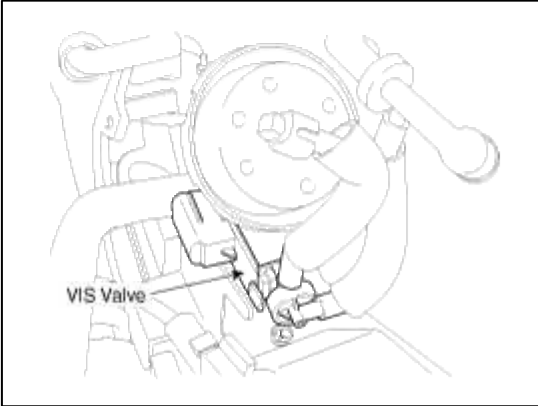
**SORENTO(BL) >2007 > G 3.3 DOHC > Fuel System**

**INSPECTION**

**FUNCTION AND OPERATION PRINCIPLE**

Variable Intake Solenoid (VIS) Valve is installed on the intake manifold and is used to improve intake efficiency.

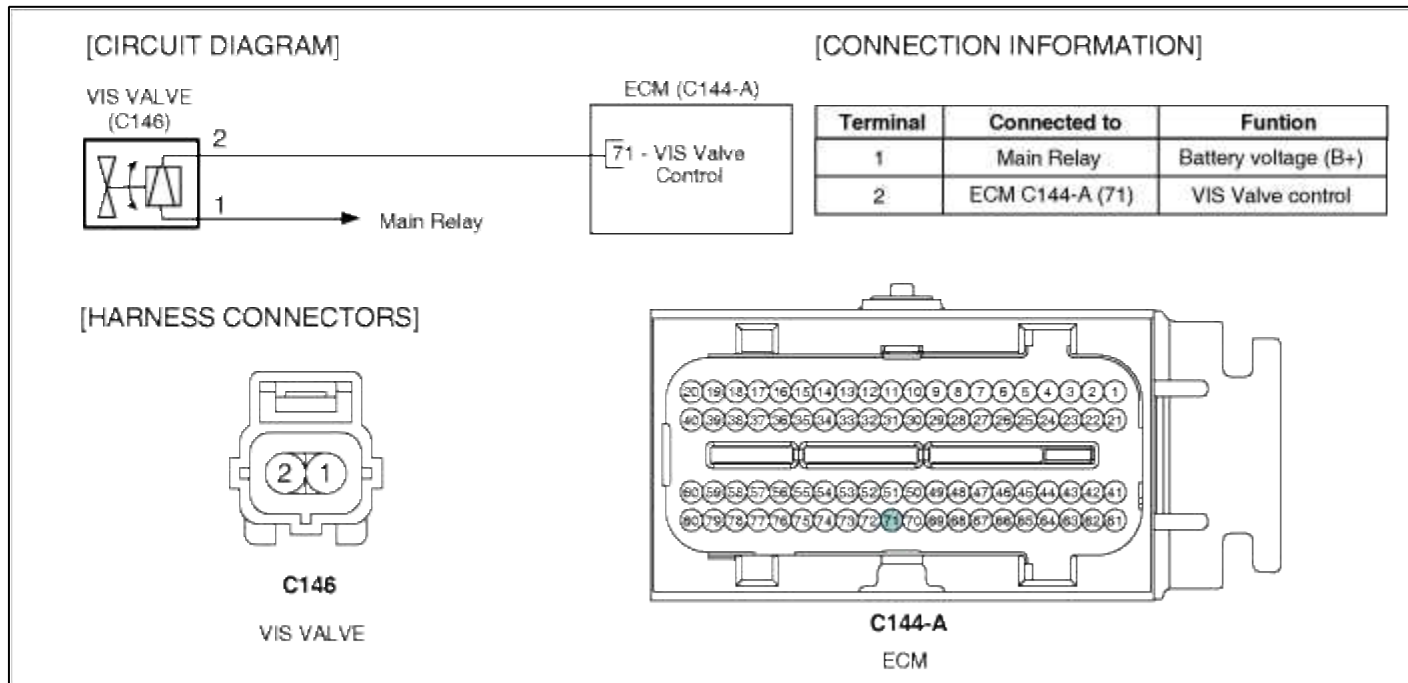
- 1. Low/Middle Speed: VIS Valve Close → Resonation Effect → Improving Intake Efficiency
- 2. High Speed: VIS Valve Open → Improving Intake Inertia Effect → Improving Intake Efficiency



**SPECIFICATION**

Item	Specification
Coil Resistance ( $\Omega$ )	30.0 ~ 35.0 $\Omega$ at 22°C (71.6°F)

## SCHEMATIC DIAGRAM



## COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect VIS Valve connector.
3. Measure resistance between VIS Valve terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.



## SORENTO(BL) > 2007 > G 3.3 DOHC > Engine Electrical System

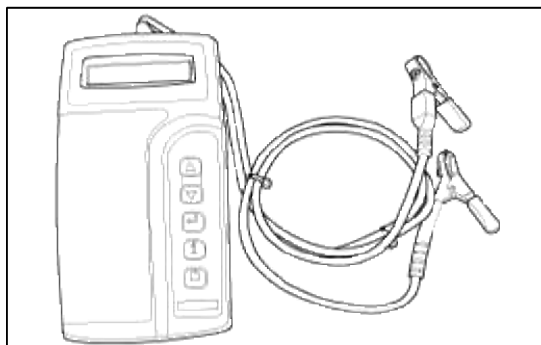
### Engine Electrical System > General Information > General Information

#### THE MICRO 570 ANALYZER

The MICRO 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and generator.

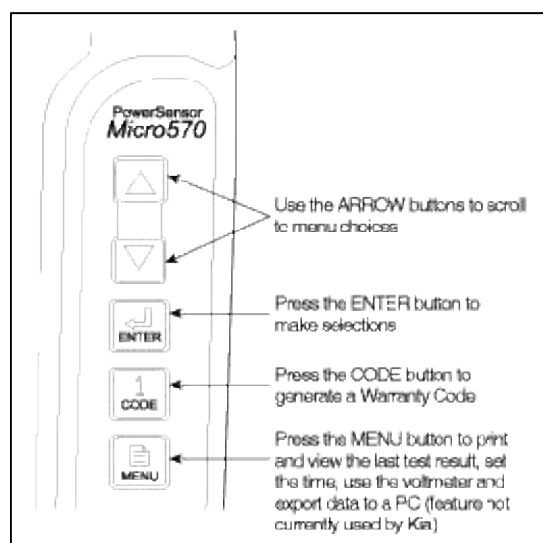
#### CAUTION

Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.



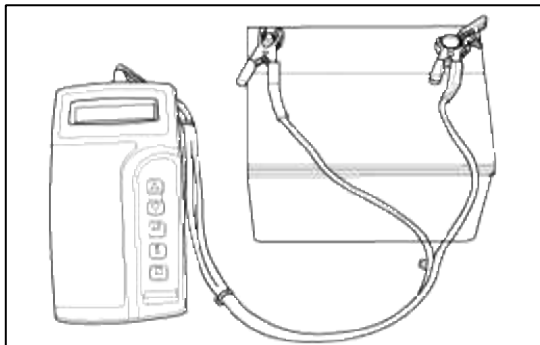
#### KEYPAD

The MICRO570 button on the key pad provides the following functions :



#### BATTERY TEST PROCEDURE

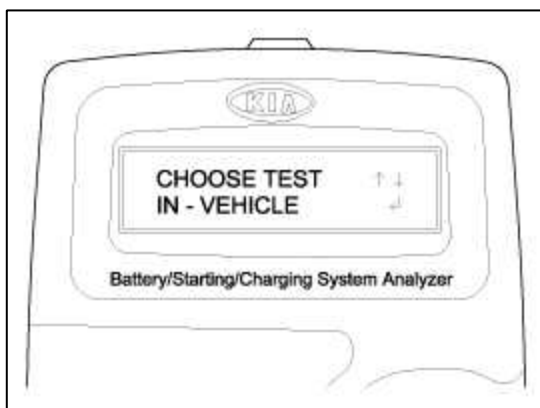
1. Connect the tester to the battery.
  - A. Red clamp to battery positive (+) terminal.
  - B. Black clamp to battery negative (-) terminal.



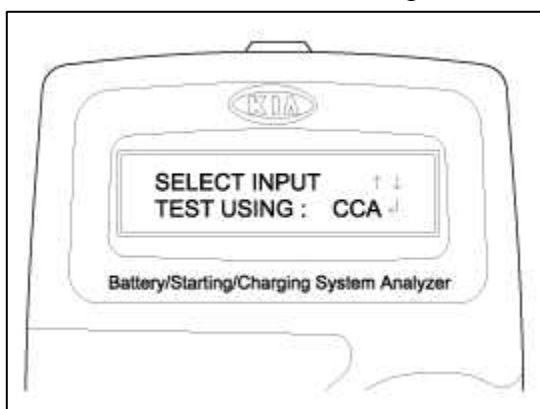
#### CAUTION

Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN A VEHICLE" or "OUT OF A VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



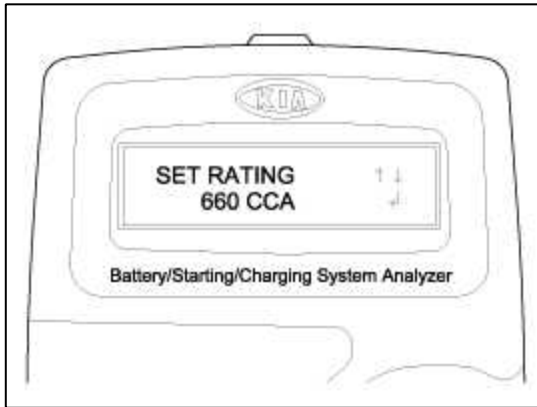
3. Choose either CCA or CCP and press the ENTER button.



#### NOTE

- CCA : Cold cranking amps, is an SAE specification for cranking batteries at -18°C (0°F).
- CCP : Cold cranking amps, is an SAE specification for korean manufacturer's for cranking batteries at -18°C (0°F).

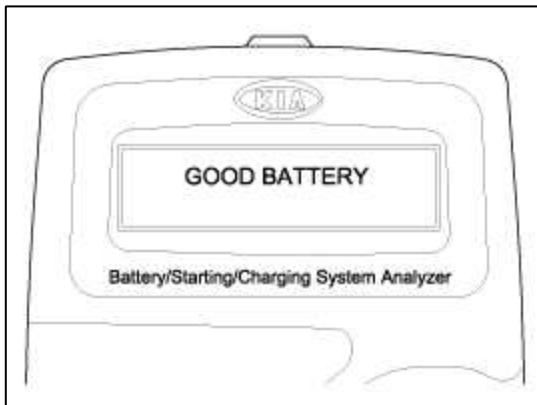
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



**NOTE**

The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

5. The tester (Micro570) displays battery test results including voltage and battery ratings.  
A relevant action must be given according to the test results by referring to the battery test results as shown in the table below.



**NOTE**

The battery ratings (CCA) displayed on the tester must be identical to the ratings marked on battery label.

6. To conduct starter test, press ENTER.

## **BATTERY TEST RESULTS**

RESULT ON PRINTER	REMEDY
Good battery	No action is required
Good recharge	Battery is in a good state Recharge the battery and use
Charge Retest	Battery is not charged properly = gt; Charge and test the battery again (Failure to charge the battery fully may read incorrect measurement value)
Replace battery	= gt; Replace battery and recheck the charging system. (Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery)
Bad cell-replace	= gt; Charge and retest the battery. And then, test results may cause "REPLACE BATTERY", replace battery and recheck the charging system

**WARNING**

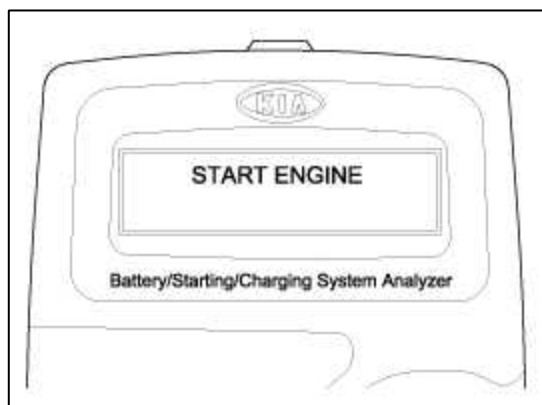
Whenever filing a claim for battery, the print out of the battery test results must be attached.

**STARTER TEST PROCEDURE**

1. After the battery test, press ENTER immediately for the starter test.

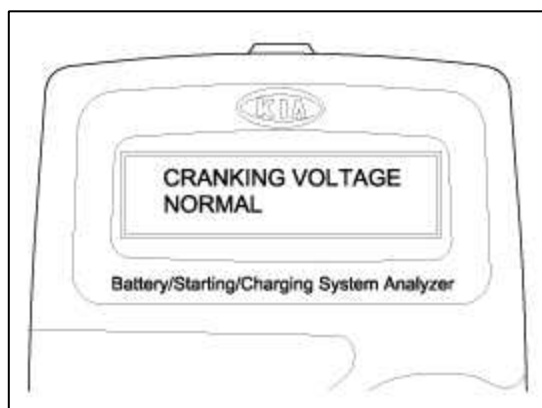


2. After pressing ENTER key, start the engine.



3. Cranking voltage and starter test results will be displayed on the screen.

Take a relevant action according to the test results by referring to the starter test results as given below.



4. To continue charging system test, press ENTER.

#### STARTER TEST RESULTS

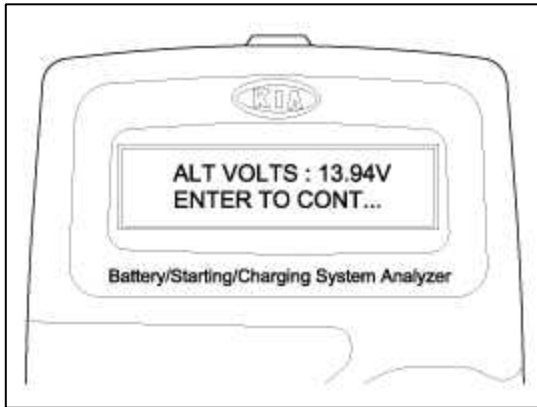
RESULT ON PRINTER	REMEDY
Cranking voltage normal	System shows a normal starter draw
Cranking voltage low	Cranking voltage is lower than normal level = gt; Check starter
Charge battery	The state of battery charge is too low to test = gt; Charge the battery and retest
Replace battery	= gt; Replace battery = gt; If the vehicle is not started though the battery condition of "Good and fully charged" is displayed. = gt; Check wiring for open circuit, battery cable connection, starter and repair or replace as necessary.

#### CHARGING SYSTEM TEST PROCEDURE

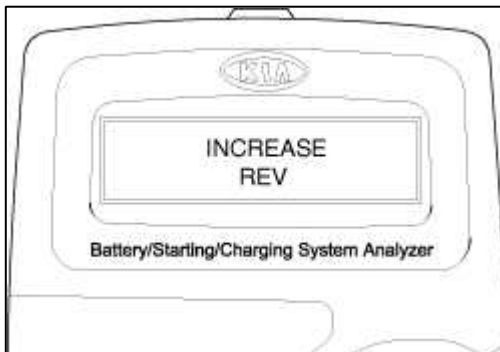
1. Press ENTER to begin charging system test.



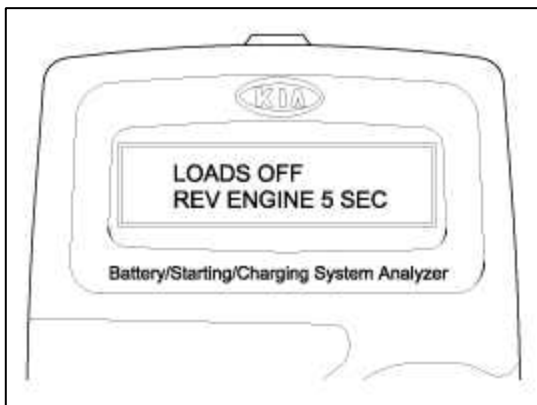
2. ENTER button is pressed, the tester displays the actual voltage of generator.  
Press ENTER to test the charging system.



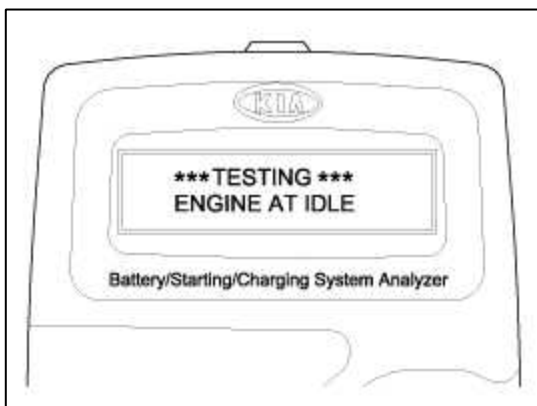
3. The MICRO 570 will prompt you to rev the engine until the rev detected. It will then collect the data.



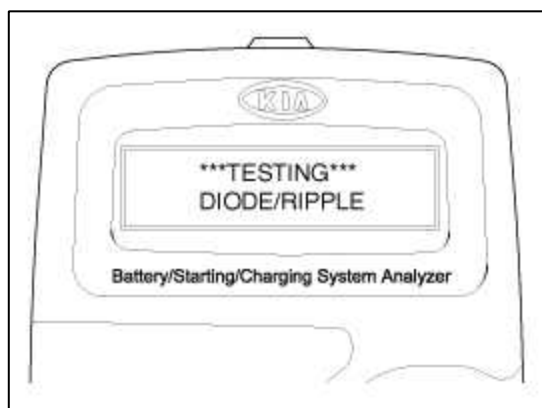
4. Press ENTER.



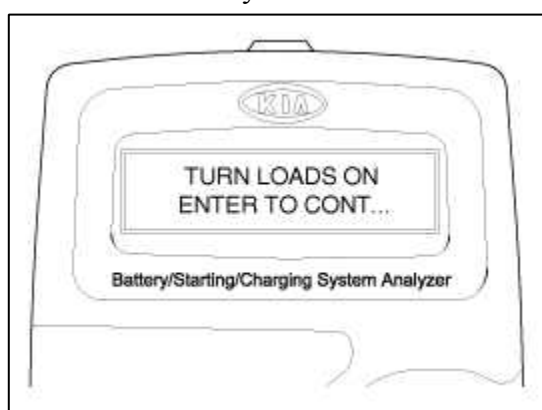
5. The MICRO 570 will analyze the charging system output at idle for comparison to other readings.



6. The MICRO 570 will detect the amount of ripple from the charging system to the battery. Excessive ripple usually means the stator is damaged or that one or more generator diodes have failed.

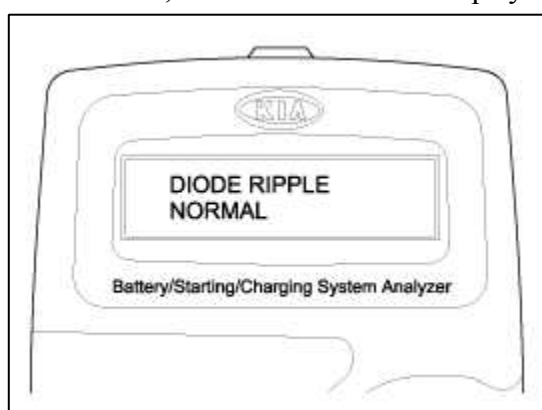


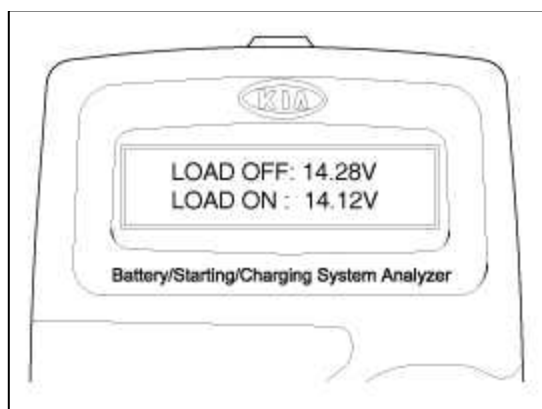
7. The MICRO 570 will prompt you to turn on accessory loads. It will then test at idle and prompt you to rev the engine. The analyzer will determine if the charging system can provide enough current for the demands of the vehicle's electrical system.

**NOTE**

When asked to turn of the accessory loads, turn of the blower to high(heater), the high beam beadlights, and rear defogger. DO NOT use cyclical loads such as air conditioning or wind-shield wipers.

8. After the test, the MICRO 570 will display the idle voltage, load voltage and the state results.



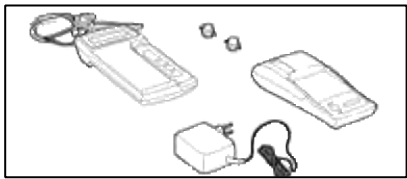


### CHARGING SYSTEM TEST RESULTS

RESULT ON PRINTER	REMEDY
Charging system normal/Diode ripple normal	Charging system is normal
No charging voltage	Generator does not supply charging current to battery = gt; Check belts, connection between generator and battery Replace belts or cable or generator as necessary
Low charging voltage	Generator does not supply charging current to battery and electrical load to system fully = gt; Check belts and generator and replace as necessary
High charging voltage	The voltage from generator to battery is higher than normal limit during voltage regulating. = gt; Check connection and ground and replace regulator as necessary = gt; Check electrolyte level in the battery
Excess ripple detected	One or more diodes in the generator is not functioning properly = gt; Check generator mounting and belts and replace as necessary

### Engine Electrical System > General Information > Special Service Tools

#### REFERENCE SERVICE TOOLS

Tool (Number and name)	Illustration	Use
Micro-570 Battery checker		(Using with Terminal Pinter_182-003A)

### Engine Electrical System > General Information > Troubleshooting

#### TROUBLESHOOTING

#### IGNITION SYSTEM



Symptom	Suspect area	Remedy
Engine will not start or is hard to start (Crank OK)	Ignition lock switch Ignition coil Spark plugs Ignition wiring disconnected or broken	Inspect ignition lock switch, or replace as required Inspect ignition coil, or replace as required Inspect spark plugs, or replace as required Repair wiring, or replace as required
Rough idle or stalls	Ignition wiring Ignition coil	Repair wiring, or replace as required Inspect ignition coil, or replace as required
Engine hesitates/poor acceleration	Spark plugs and spark plug cables Ignition wiring	Inspect spark plugs / cable, or replace as required Repair wiring, or replace as required
Poor mileage	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required

## CHARGING SYSTEM

Symptom	Suspect area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off.	Fuse blown Light burned out Wiring connection loose Electronic voltage regulator	Check fuses Replace light Tighten loose connection Replace voltage regulator
Charging warning indicator does not go out with engine running. (Battery requires frequent recharging)	Drive belt loose or worn Battery cable loose, corroded or worn Electronic voltage regulator or alternator Wiring	Adjust belt tension or replace belt Inspect cable connection, repair or replace cable Replace voltage regulator or alternator Repair or replace wiring
Overcharge	Electronic voltage regulator Voltage sensing wire	Replace voltage regulator Repair or replace wiring
Discharge	Drive belt loose or worn Wiring connection loose or short circuit Electronic voltage regulator or alternator Poor grounding Worn battery	Adjust belt tension or replace belt Inspect wiring connection, repair or replace wiring Replace voltage regulator or alternator Inspect ground or repair Replace battery

## STARTING SYSTEM

Symptom	Suspect area	Remedy
Engine will not crank	Battery charge low Battery cables loose, corroded or worn out Transaxle range switch (Vehicle with automatic transaxle only) Fuse blown Starter motor faulty Ignition switch faulty	Charge or replace battery Repair or replace cables Refer to TR group-automatic transaxle  Replace fuse Replace Replace
Engine cranks slowly	Battery charge low Battery cables loose, corroded or worn out Starter motor faulty	Charge or replace battery Repair or replace cables Replace
Starter keeps running	Starter motor Ignition switch	Replace Replace
Starter spins but engine will not crank	Short in wiring Pinion gear teeth broken or starter motor Ring gear teeth broken	Repair wiring Replace Replace fly wheel or torque converter

### Engine Electrical System > General Information > Specifications

#### SPECIFICATIONS

Items			Specification
Ignition coil	Primary resistance		0.62 ± 10 %
	Secondary resistance		7.0kΩ ± 15 %
Spark plugs	Unleaded	NGK	IFR5G-11
		Gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)

#### STARTING SYSTEM

Items			Specification
Starter	Rated voltage		12 V, 1.4 kW
	No. of pinion teeth		8
	No-load characteristics	Voltage	11.5 V
		Ampere	85A, MAX
		Speed	2,600 rpm, MIN

#### CHARGING SYSTEM

Items		Specification	
Alternator	Type	Battery voltage sensing	
	Rate voltage	13.5 V, 130A	
	Speed in use	1,000 ~ 18,000 rpm	
	Voltage regulator	IC regulator built-in type	
	Regulator setting voltage	14.2 ~ 14.8 V (500 RPM, 10A, 25°C)	
Battery	Type	3.3L	3.8L
		CMF 70AH	CMF 80AH
	Cold cranking amperage [at -18°C(-0.4°F)]	600 A	660 A
	Reserve capacity	120 min	145 min
	Specific gravity [at 25°C(77°F)]	1.280 ± 0.01	←

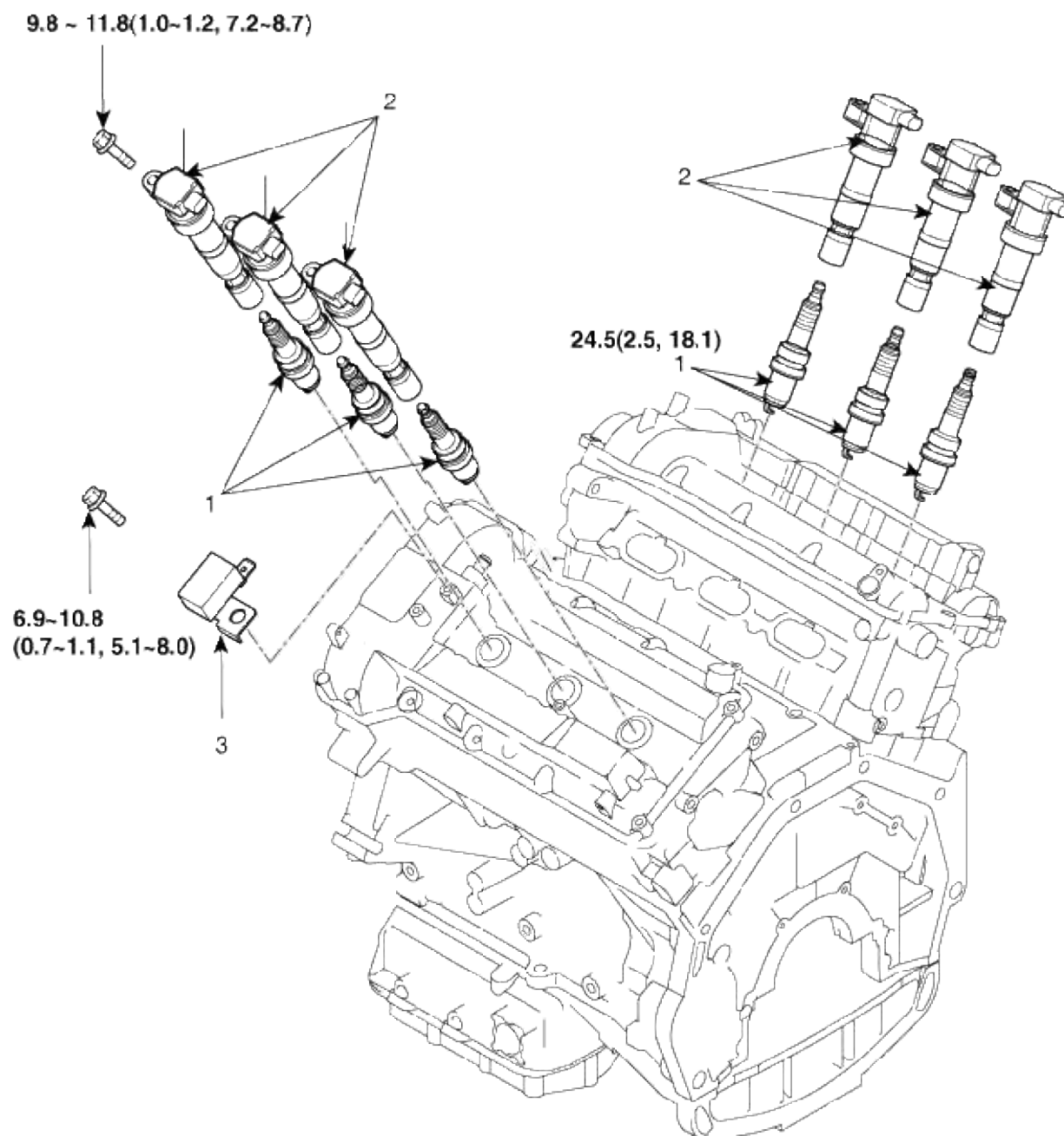
**NOTE**

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- RESERVE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80.1°F).

**Engine Electrical System > Ignition System > Description and Operation****DESCRIPTION**

Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are preprogrammed in the memory of the ECM (Engine Control Module). The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.

**Engine Electrical System > Ignition System > Components and Components Location****COMPONENTS**



TORQUE : Nm (kgf.m, lb-ft)

- 1. Spark plug
- 2. Ignition coil
- 3. Condenser

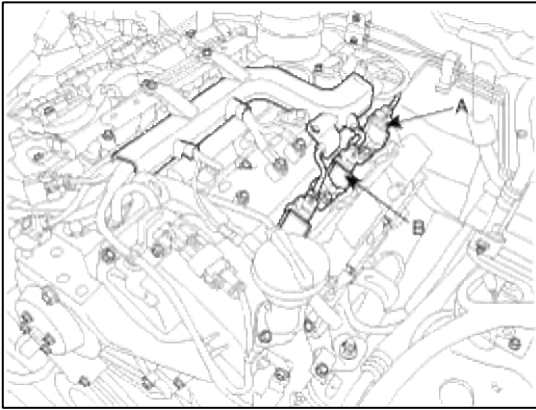
## Engine Electrical System > Ignition System > Repair procedures

### REMOVAL

#### IGNITION COIL

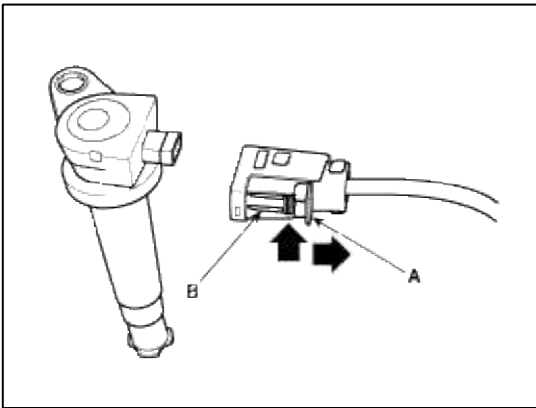
1. Remove the engine cover.

2. Disconnect the ignition coil connector(A).



#### NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).

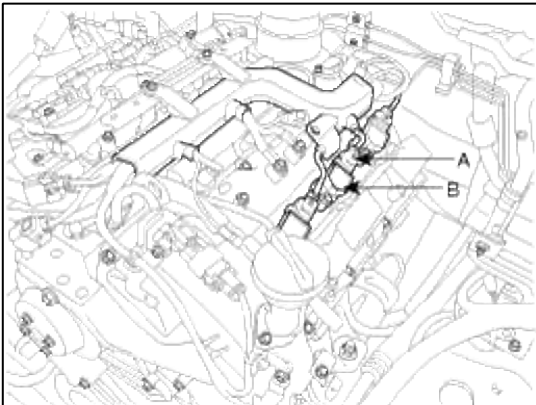


3. Remove the ignition coil (B).
4. Installation is the reverse of removal.

## ON-VEHICLE INSPECTION

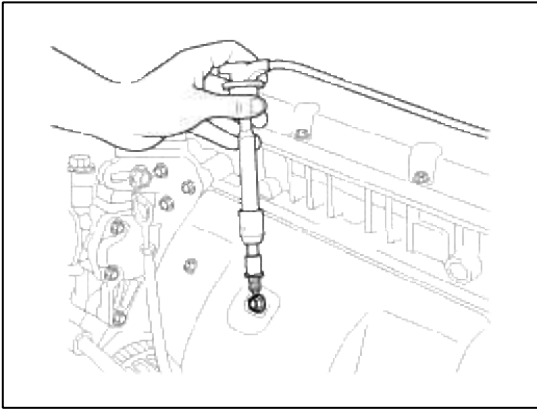
### SPARK TEST

1. Remove the ignition coil connector(A).



2. Remove the ignition coil(B).
3. Using a spark plug socket, remove the spark plug.
4. Install the spark plug to the ignition coil.

5. Ground the spark plug to the engine.

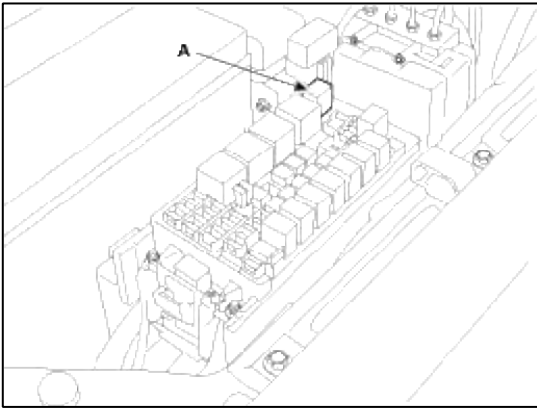


6. Check if spark occurs while engine is being cranked.

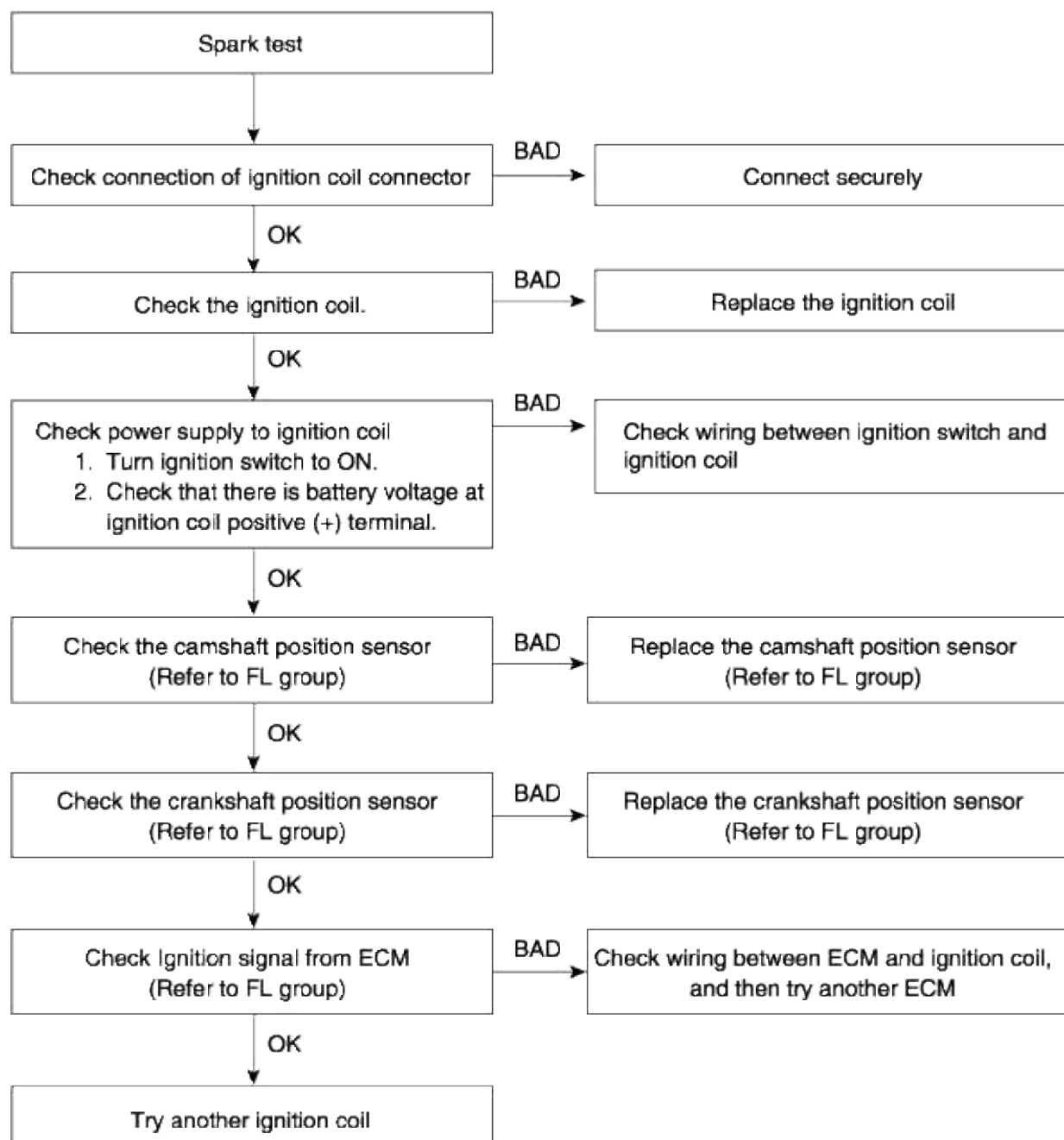
**NOTE**

To prevent fuel being injected from injectors while the engine is being cranked, remove the fuel pump(A) relay from the fuse box.

Crank the engine for no more than 5 ~ 10 seconds.

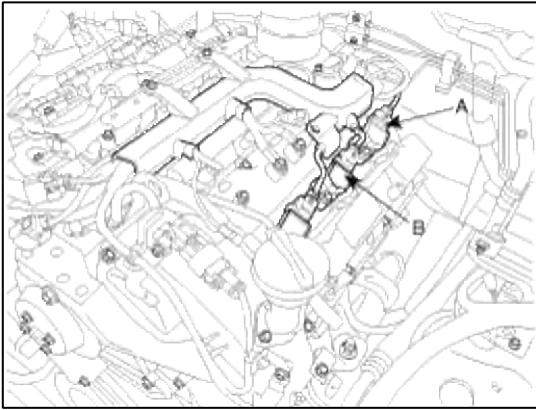


7. Inspect all the spark plugs.
8. Using a spark plug socket, install the spark plug.
9. Install the ignition coil.
10. Reconnect the ignition coil connector.



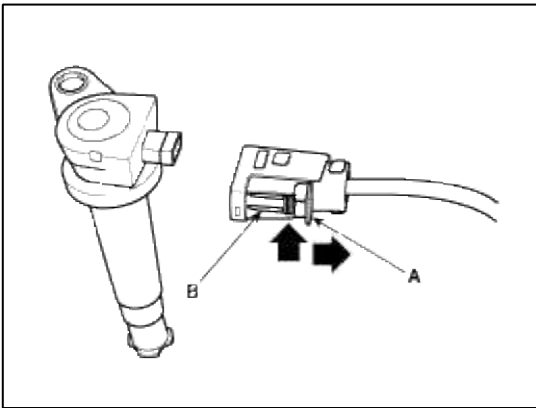
## INSPECT SPARK PLUG

1. Remove the ignition coil connector(A).



#### NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).

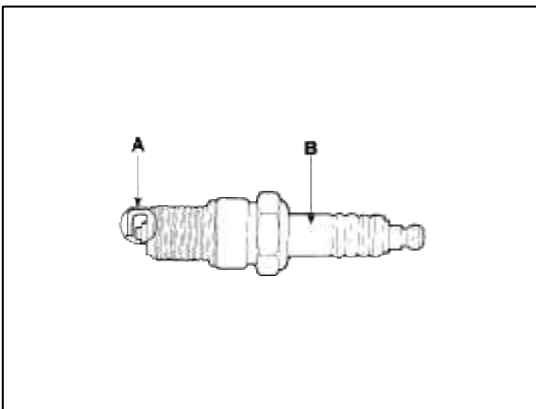


2. Remove the ignition coil(B).
3. Using a spark plug socket, remove the spark plug.

#### CAUTION

Be careful that no contaminants enter through the spark plug holes.

4. Inspect the electrodes (A) and ceramic insulator (B).



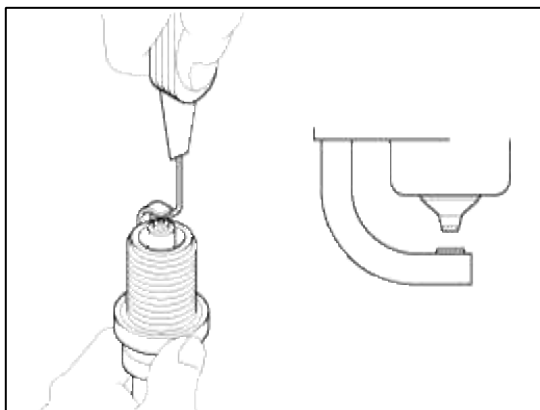
#### INSPECTION OF ELECTRODES



Condition	Dark deposits	White deposits
Description	<ul style="list-style-type: none"> <li>- Fuel mixture too rich</li> <li>- Low air intake</li> </ul>	<ul style="list-style-type: none"> <li>- Fuel mixture too lean</li> <li>- Advanced ignition timing</li> <li>- Insufficient plug tightening torque</li> </ul>

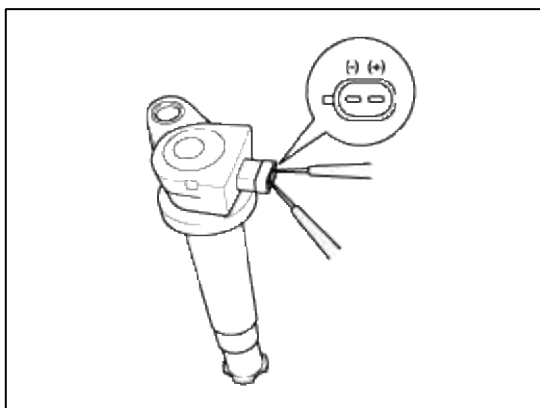
#### 5. Check the electrode gap (A).

Standard : 1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)



#### INSPECT IGNITION COIL

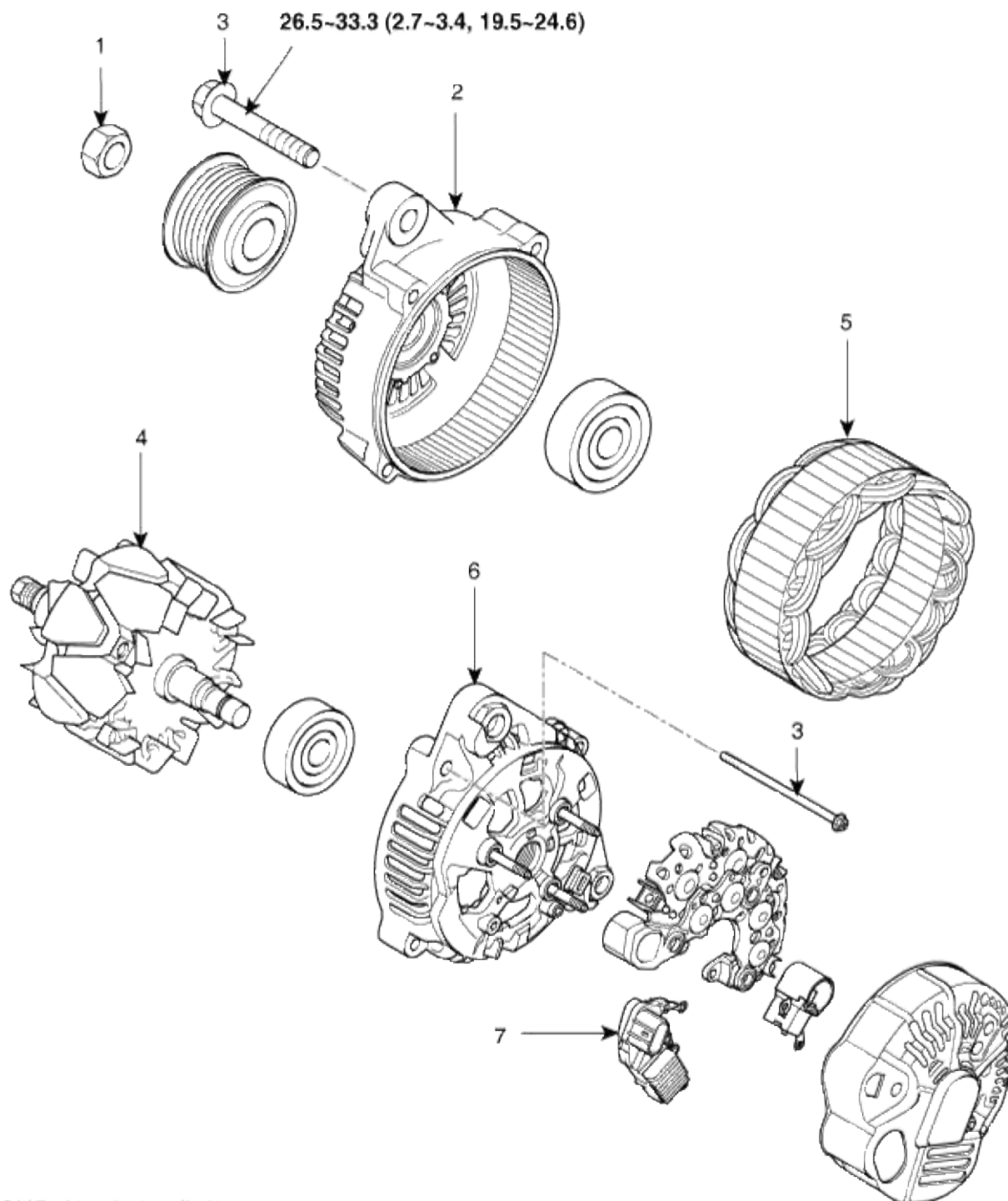
##### 1. Measure the primary coil resistance between terminals (+) and (-).



Standard value:  $0.62\Omega \pm 10\%$

**Engine Electrical System > Charging System > Alternator > Components and Components Location**

#### COMPONENTS



TORQUE : Nm (kgf.m, lb-ft)

- 1. Nut
- 2. Generator front frame assembly
- 3. Bolt
- 4. Rotor assembly

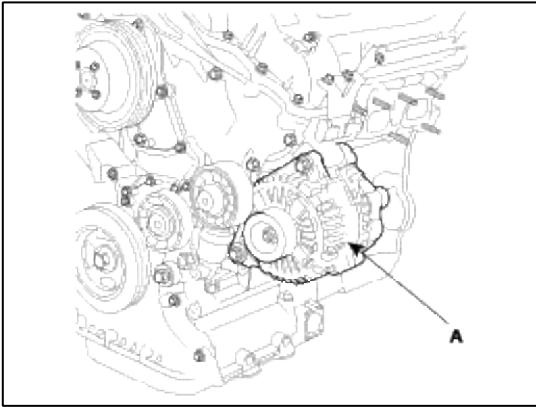
- 5. Stator assembly
- 6. Rear bracket assembly
- 7. Regulator assembly

## Engine Electrical System > Charging System > Alternator > Repair procedures

### REMOVAL

1. Disconnect the battery negative terminal first, then the positive terminal.
2. Disconnect the alternator connector, and remove the cable from alternator "B" terminal.
3. Remove the drive belt.

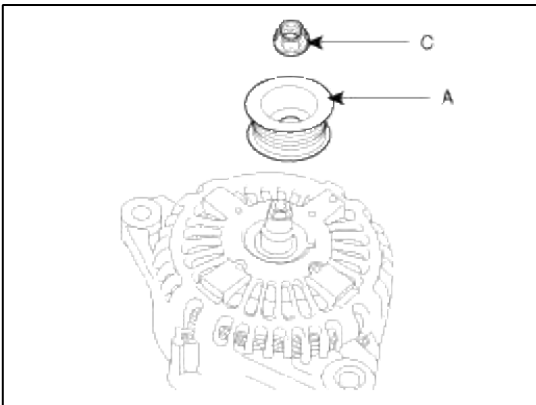
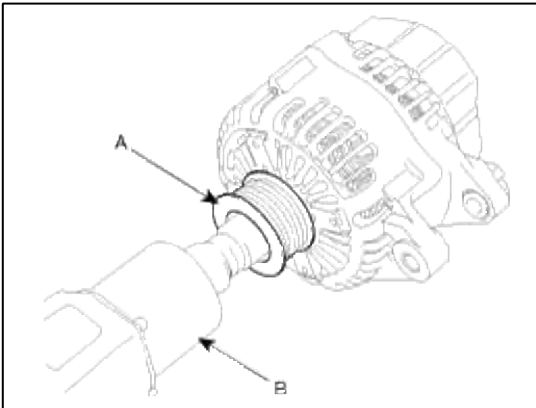
4. Pull out the through bolt and then remove the alternator(A).



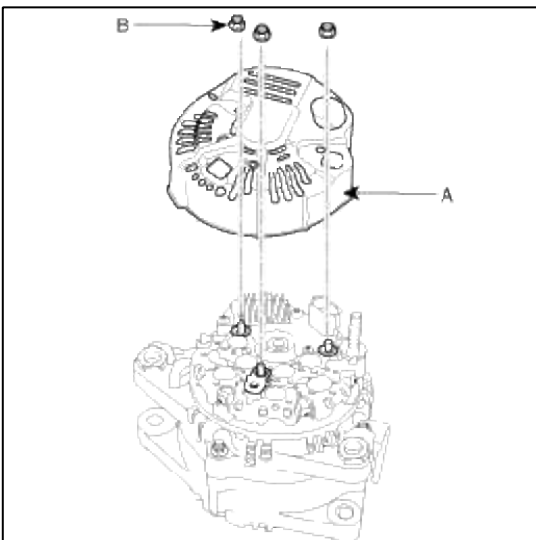
5. Installation is the reverse of removal.

## DISASSEMBLY

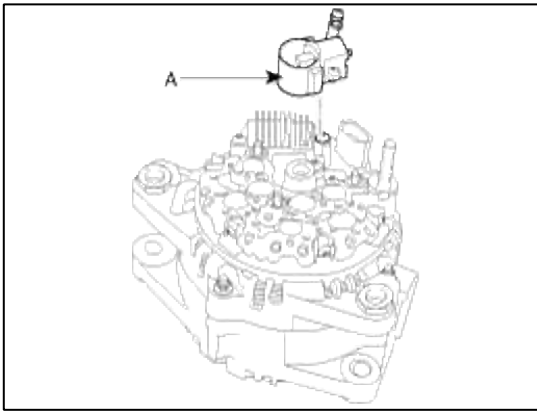
1. If the front bearing needs replacing, remove the pulley(A) lock nut(C) with an impact wrench(B).



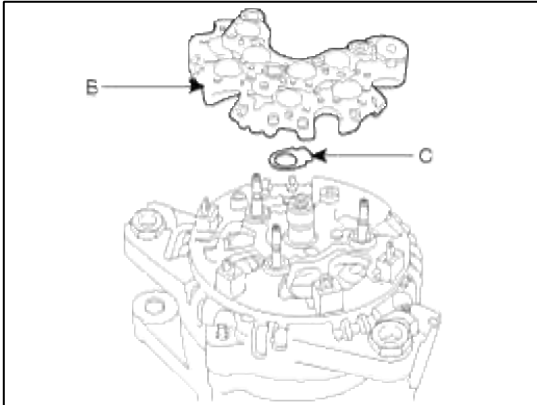
2. Remove the generator cover(A) after removing the three nuts(B).



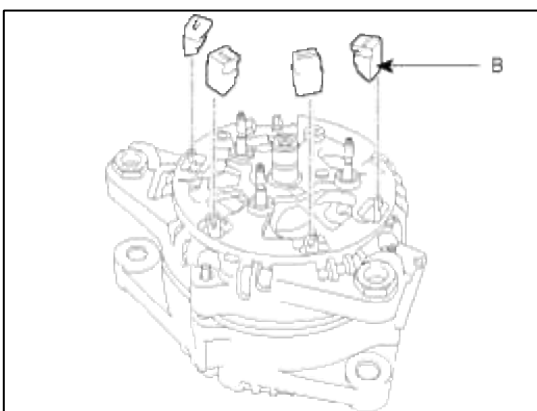
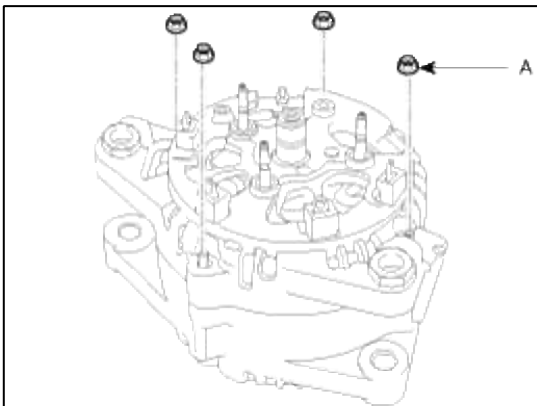
3. Remove the brush holder(A).



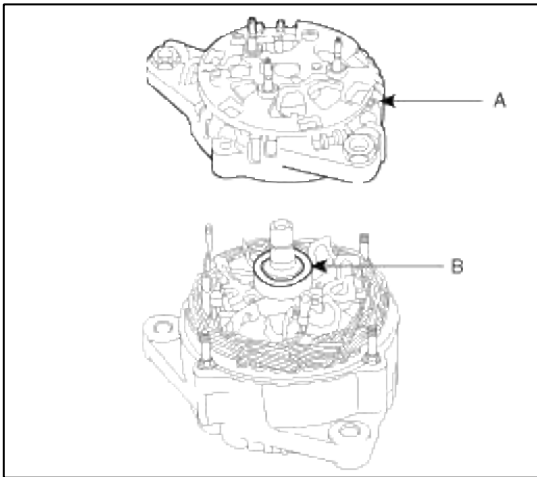
4. Remove the four screws, the rectifier(B) and the rubber seal(C).



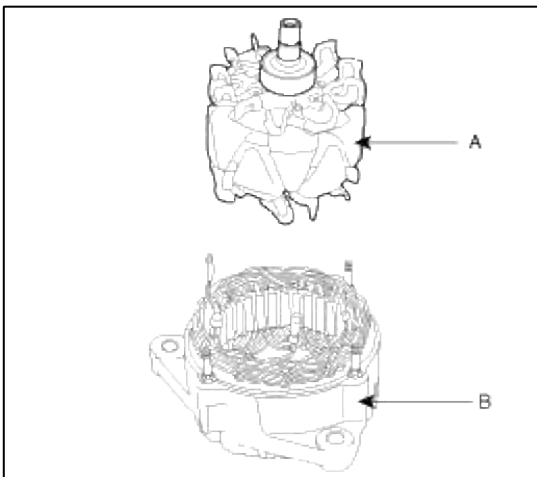
5. Remove the four nuts(A) and insulators(B).



6. Remove the rear bracket assembly(A) and washer(B).



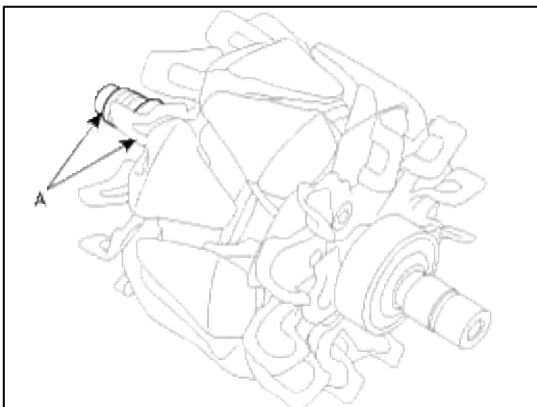
7. Remove the rotor(A) from the stator and front frame assembly(B).



## INSPECTION

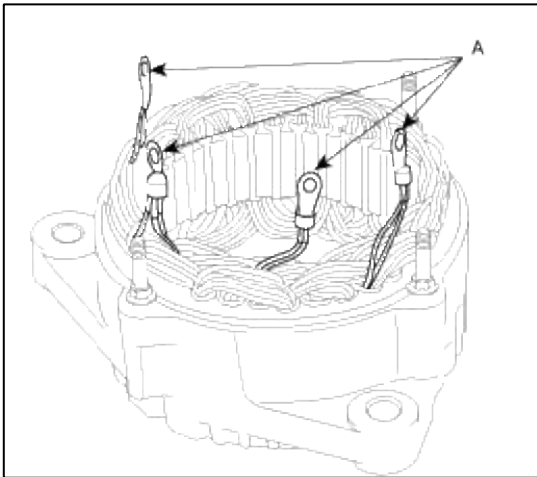
### ROTOR

1. Check that there is continuity between the slip rings(A). If there is no continuity, replace the generator.



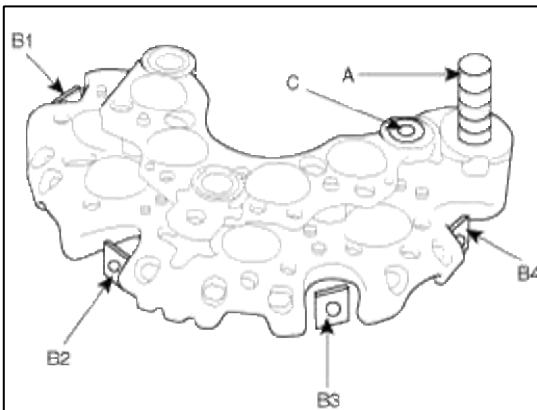
### STATOR

1. Check that there is continuity between each pair of leads(A). If there is no continuity, replace the generator.



## RECTIFIER

1. Check for continuity in each direction, between the B terminal(A) and P terminals(B), between the E terminal(C) and P terminals(B) of each diode pair. All diodes should have continuity in only one direction. Because the rectifier diodes are designed to allow current to pass in one direction, and the rectifier is made up of eight diodes(four pairs), you must test each diode in both directions for continuity with an ohmmeter that has diode checking capability: a total of 16 checks. If any diode failed, replace the rectifier assembly.

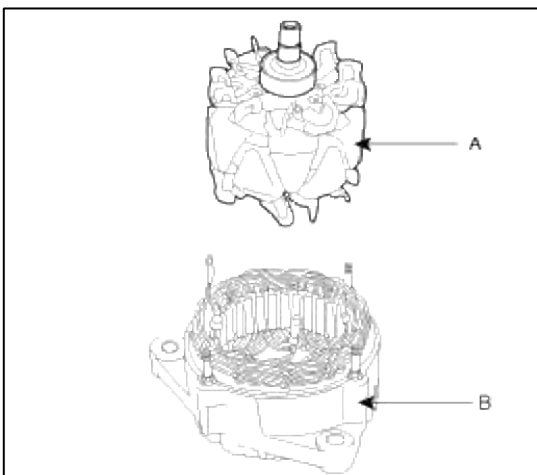


## REASSEMBLY

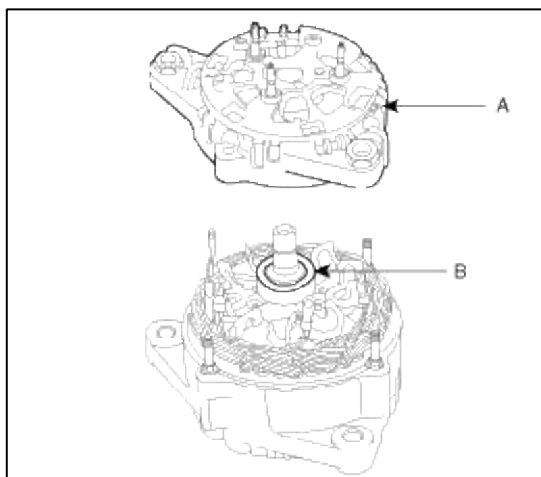
### NOTE

Be careful not to get any grease or oil on the slip rings.

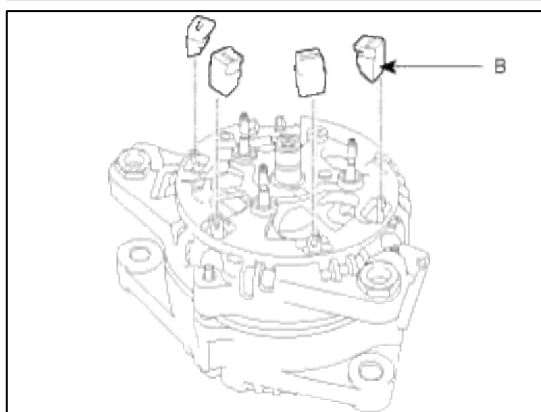
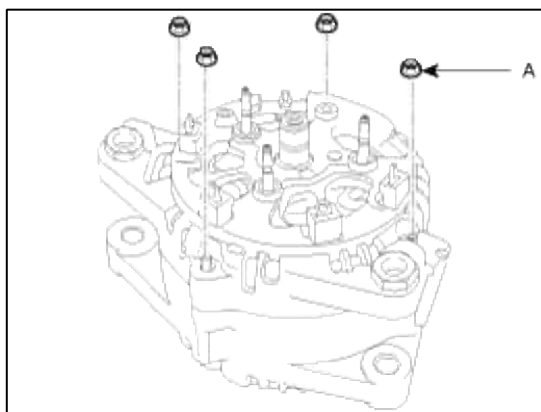
1. Insert the rotor(A) in the stator and front frame assembly(B).



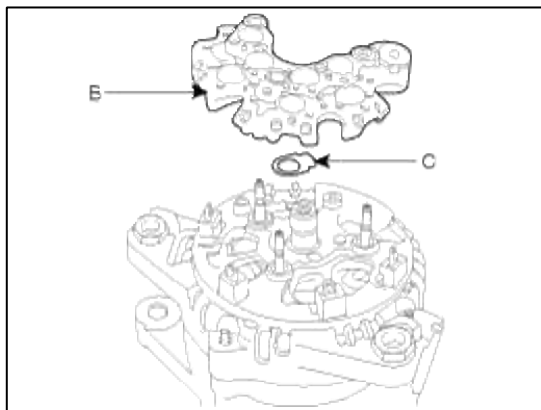
2. Install the washer(B) and the rear bracket assembly(A)



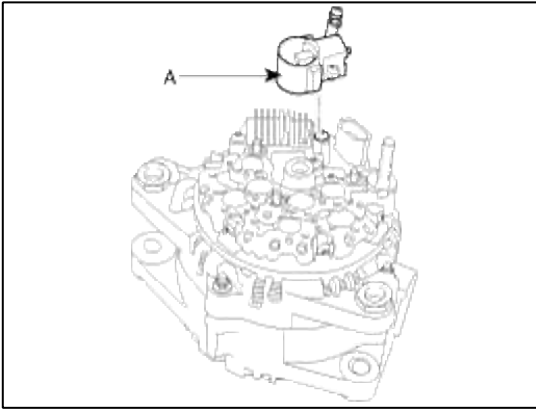
3. Tighten the four nuts and insulators(B).



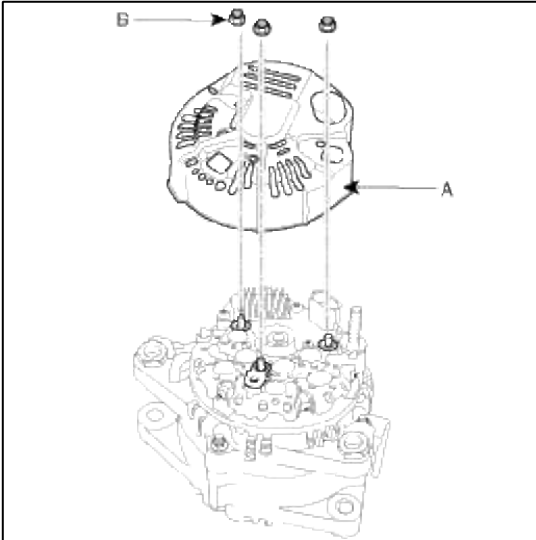
4. Install the rectifier(B) and the rubber seal(C) by tightening the four screws(A),



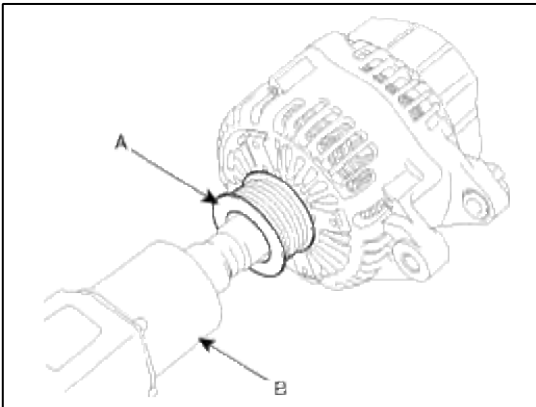
5. Install the brush holder(A).



6. Install the generator cover(A) by tightening the three nuts(B).



7. Install the pulley lock nut with an impact wrench.



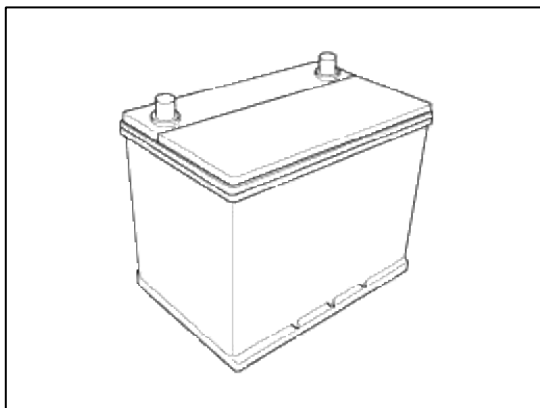
## Engine Electrical System > Charging System > Battery > Description and Operation

### DESCRIPTION

1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.



3. The battery is completely sealed, except for small vent holes in the cover.



### Engine Electrical System > Charging System > Battery > Repair procedures

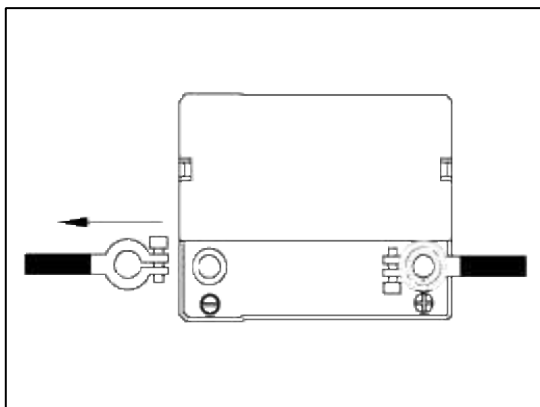
#### BATTERY DIAGNOSTIC TEST (2)

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

#### CAUTION

Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte.

Heavy rubber gloves (not the household type) should be worn when removing the battery.



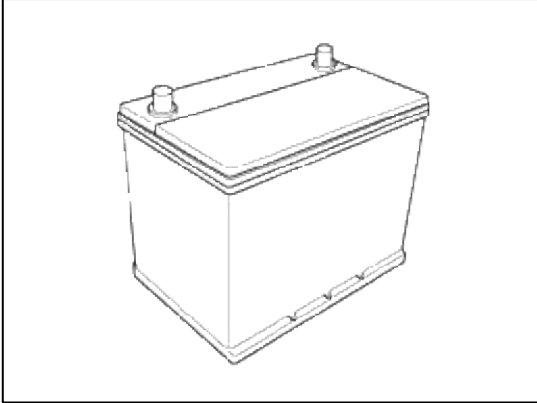
4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.

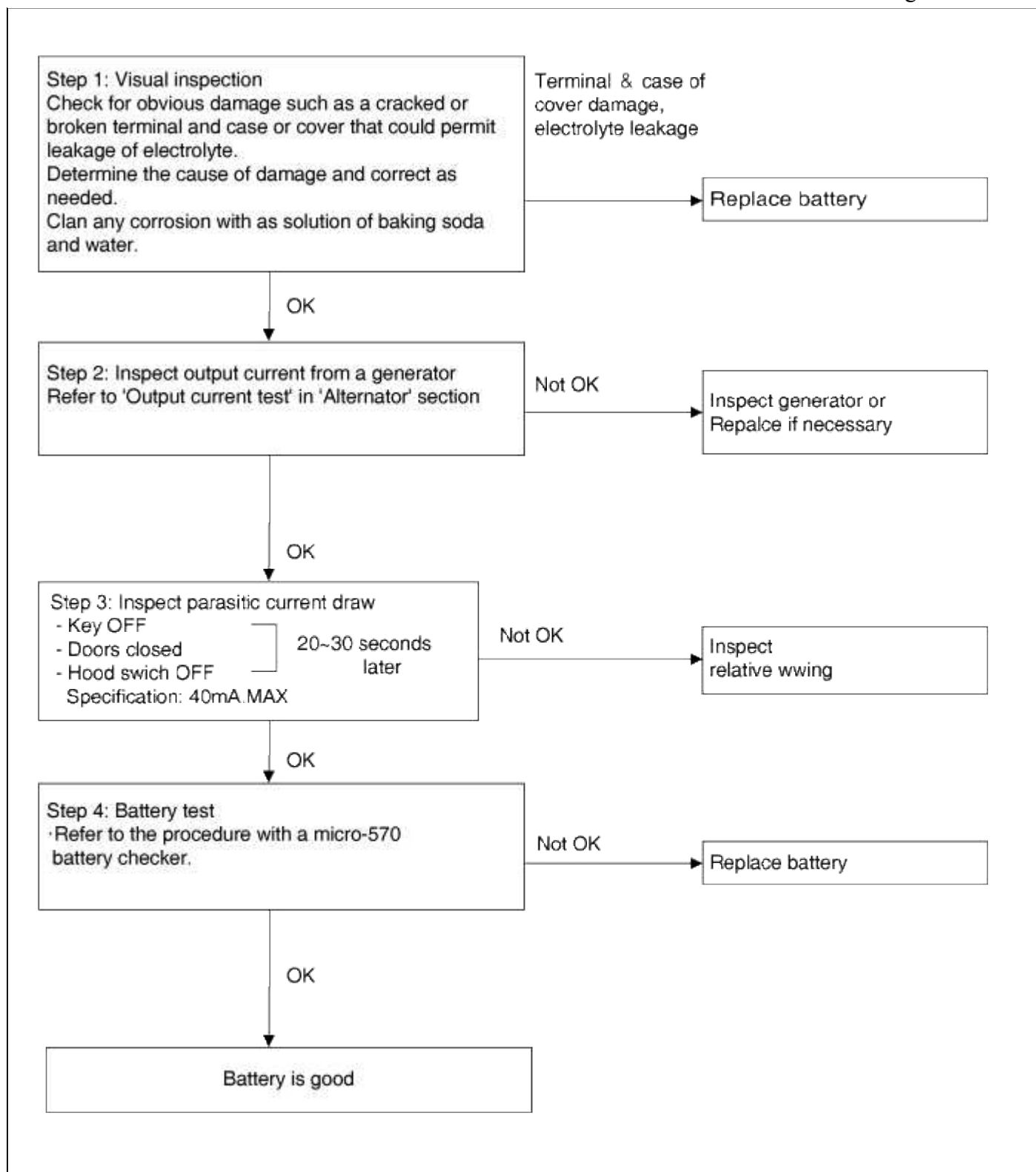
12. Coat all connections with light mineral grease after tightening.

**CAUTION**

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.

A spark will occur when the circuit is broken. Keep open flames away from battery.

**INSPECTION****BATTERY DIAGNOSTIC FLOW**



## LOAD TEST

1. Perform the following steps to complete the load test procedure for maintenance free batteries.

2. Connect the load tester clamps to the terminals and proceed with the test as follow:

- (1) If the battery has been on charge, remove the surface charge by connecting a 300ampere load for 15 seconds.
- (2) Connect the voltmeter and apply the specified load.
- (3) Read the voltage after the load has been applied for 15 seconds.
- (4) Disconnect the load.
- (5) Compare the voltage reading with the minimum and replace the battery if battery test voltage is below that shown in the voltage table.

Voltage	Temperature
9.6V	20°C (68.0°F) and above
9.5V	16°C (60.8°F)
9.4V	10°C (50.0°F)
9.3V	4°C (39.2°F)
9.1V	-1°C (30.2°F)
8.9V	-7°C (19.4°F)
8.7V	-12°C (10.4°F)
8.5V	-18°C (-0.4°F)

#### NOTE

- If the voltage is greater than shown in the table, the battery is good.
- If the voltage is less than shown in the table, replace the battery.

### Engine Electrical System > Charging System > Description and Operation

#### DESCRIPTION

The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

The Alternator has built-in diodes, each rectifying AC current to DC current.

Therefore, DC current appears at alternator "B" terminal.

In addition, the charging voltage of this alternator is regulated by the battery voltage detection system.

The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.

### Engine Electrical System > Charging System > Repair procedures

#### ON-VEHICLE INSPECTION

#### CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Never disconnect the battery while the engine is running.

#### CHECK THE BATTERY TERMINALS AND FUSES

1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

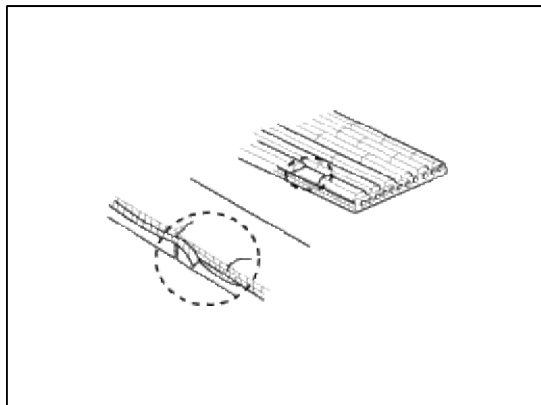
**INSPECT DRIVE BELT**

Visually check the belt for excessive wear, frayed cords etc.

If any defect has been found, replace the drive belt.

**NOTE**

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

**VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES**

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the alternator while the engine is running.

**CHECK DISCHARGE WARNING LIGHT CIRCUIT**

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.

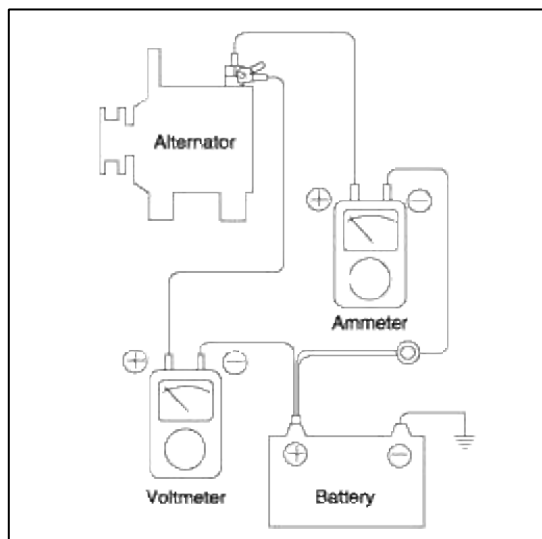
If the light does not go off as specified, troubleshoot the discharge light circuit.

**VOLTAGE DROP TEST OF ALTERNATOR OUTPUT WIRE**

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

**PREPARATION**

1. Turn the ignition switch to "OFF".
2. Disconnect the output wire from the alternator "B" terminal. Connect the (+) lead wire of ammeter to the "B" terminal of alternator and the (-) lead wire of ammeter to the output wire. Connect the (+) lead wire of voltmeter to the "B" terminal of alternator and the (-) lead wire of voltmeter to the (+) terminal of battery.

**TEST**

1. Start the engine.

2. Turn on the headlamps and blower motor, and set the engine speed until the ammeter indicates 20A.  
And then, read the voltmeter at this time.

## RESULT

1. The voltmeter may indicate the standard value.

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Standard value: 0.2V max

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2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the alternator "B" terminal to the battery (+) terminal. Check for loose connections, color change due to an over-heated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle.  
Turn off the headlamps, blower motor and the ignition switch.

## OUTPUT CURRENT TEST

This test determines whether or not the alternator gives an output current that is equivalent to the normal output.

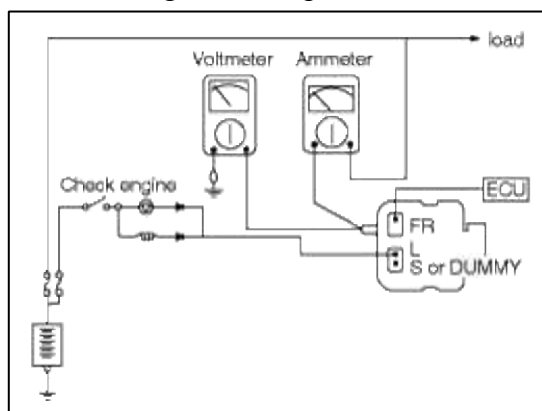
### PREPARATION

1. Prior to the test, check the following items and correct as necessary.  
Check the battery installed in the vehicle to ensure that it is in good condition. The battery checking method is described in the section "Battery".  
The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.  
Check the tension of the alternator drive belt. The belt tension check method is described in the section "Inspect drive belt".
2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

### NOTE

Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



### TEST

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between alternator "B" terminal and battery (-) terminal or poor grounding is suspected.
2. Start the engine and turn on the headlamps.

3. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

**NOTE**

After the engine start up, the charging current quickly drops.  
Therefore, the above operation must be done quickly to read the maximum current value correctly.

**RESULT**

1. The ammeter reading must be higher than the limit value. If it is lower but the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

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Limit value : 65A min.

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**NOTE**

- The nominal output current value is shown on the nameplate affixed to the alternator body.
- The output current value changes with the electrical load and the temperature of the alternator itself. Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load. The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.  
In such a case, reduce the temperature before testing again.

2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

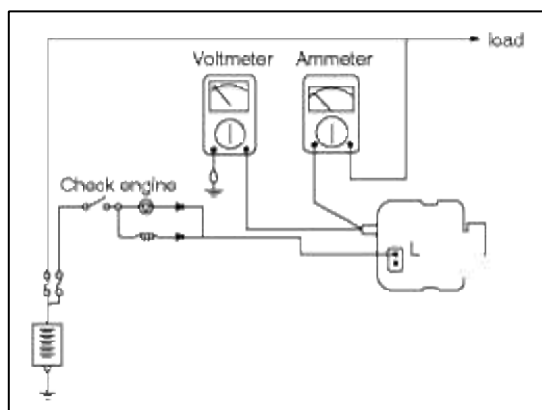
**REGULATED VOLTAGE TEST**

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

**PREPARATION**

1. Prior to the test, check the following items and correct if necessary.  
Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".  
Check the alternator drive belt tension. The belt tension check method is described in the section "Inspect drive belt".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire.  
Connect the (-) lead wire of the ammeter to the disconnected output wire.

7. Attach the engine tachometer and connect the battery ground cable.



### TEST

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

Voltage: Battery voltage

If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-) terminal.

2. Start the engine. Keep all lights and accessories off.
3. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less

### RESULT

1. If the voltmeter reading agrees with the value listed in the regulating voltage table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.

#### REGULATING VOLTAGE TABLE

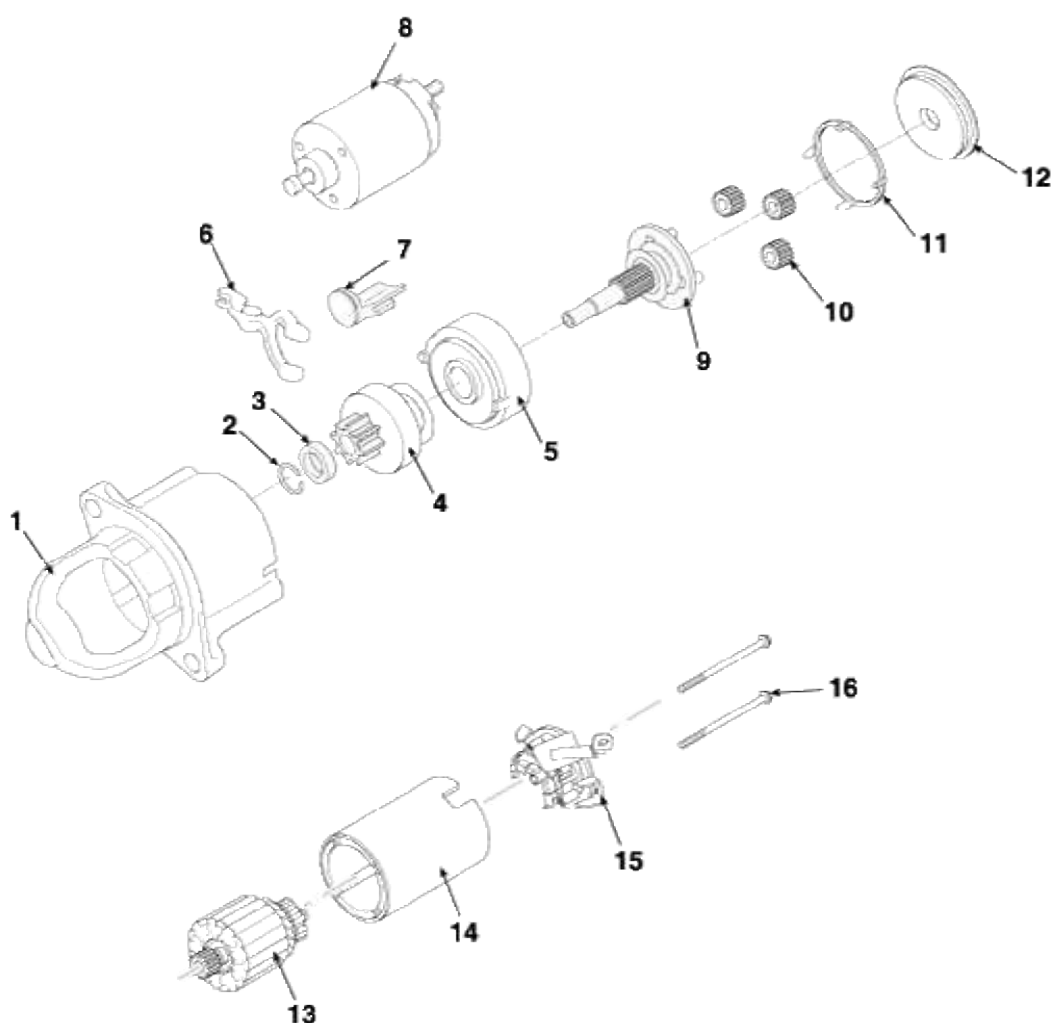
Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-30 (-22)	14.2 ~ 15.3
25 (77)	14.2 ~ 14.8
135 (275)	13.3 ~ 14.8

2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

**Engine Electrical System > Starting System > Starter > Components and Components Location**

### COMPONENTS





1. Front bracket
2. Stop ring
3. Stopper
4. Overrun clutch assembly
5. Internal gear assembly
6. Lever
7. Lever packing
8. Magnet switch assembly

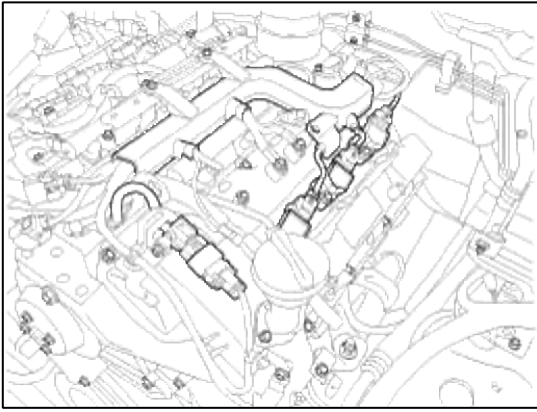
9. Planet shaft assembly
10. Planetary gear assembly
11. Packing
12. Shield
13. Armature assembly
14. Yoke assembly
15. Brush holder assembly
16. Through bolt

## Engine Electrical System > Starting System > Starter > Repair procedures

### REMOVAL

1. Remove the LH exhanst manifold assembly.

2. Supporting the engine with a safety jack, remove the LH side engine mounting bracket.



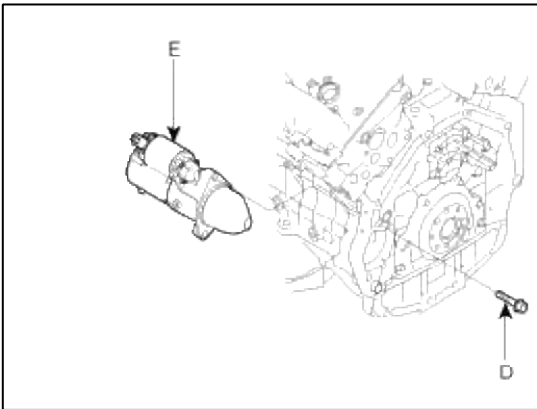
3. Disconnect the starter cable from the B terminal on the solenoid, and the connector from the S terminal.
4. Remove the 2 bolts (D) holding the starter, then remove the starter (E).

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#### TROQUE :

49.0 ~ 63.7 Nm (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0 lb-ft) - starter mounting(D)

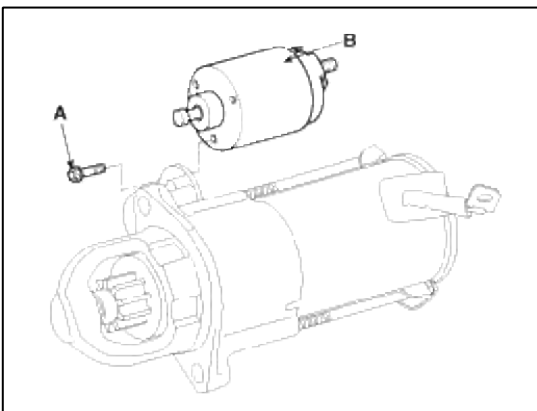
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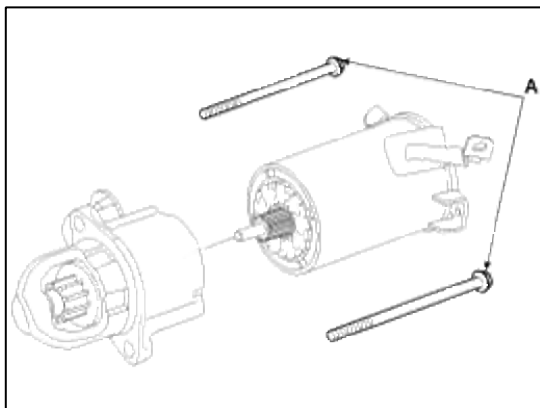
5. Installation is the reverse of removal.
6. Connect the battery negative cable to the battery.

#### DISASSEMBLY

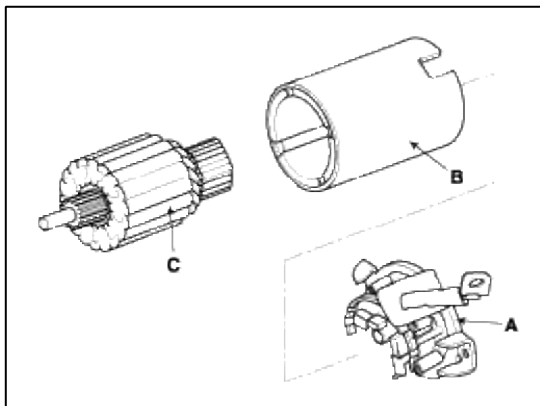
1. Disconnect the M-terminal on the magnet switch assembly.
2. After loosening the 3 screws (A), detach the magnet switch assembly (B).



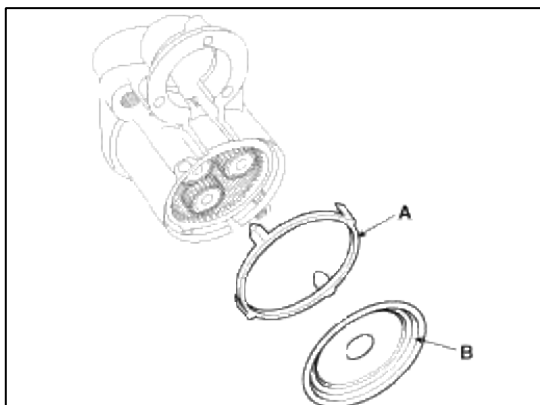
3. Loosen the through bolts (A).



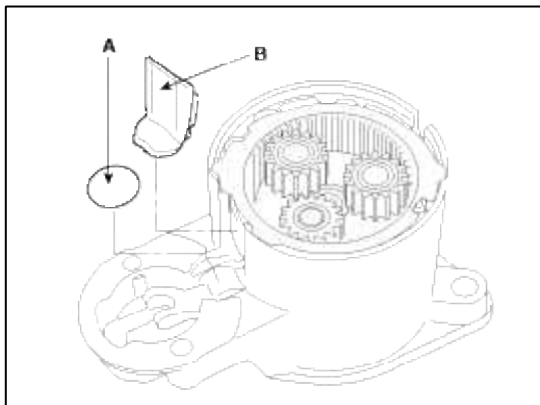
4. Remove the brush holder assembly (A), yoke (B) and armature (C).



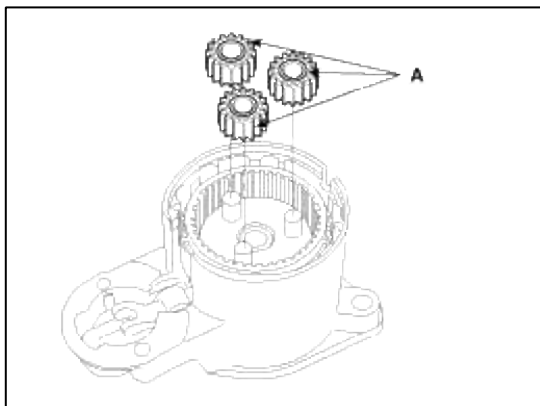
5. Remove the shield (A) and packing (B).



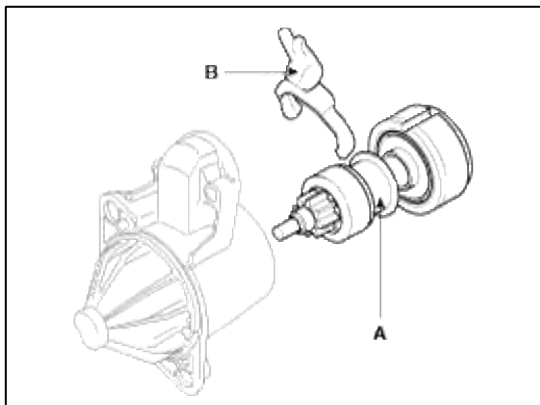
6. Remove the lever plate (A) and lever packing (B).



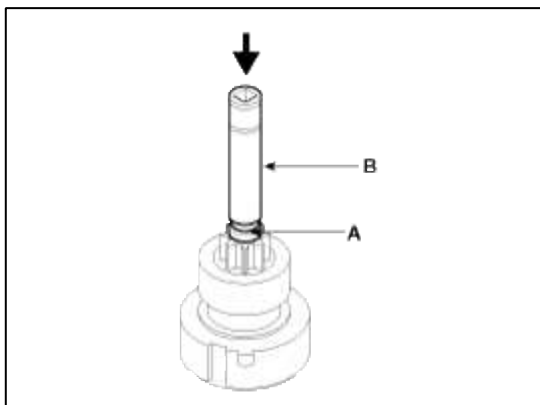
7. Disconnect the planet gear (A).



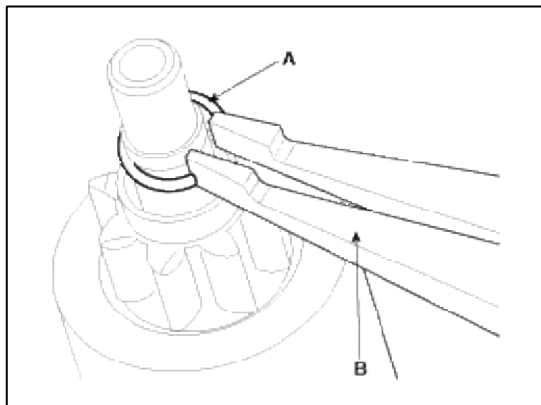
8. Disconnect the planet shaft assembly (A) and lever (B).



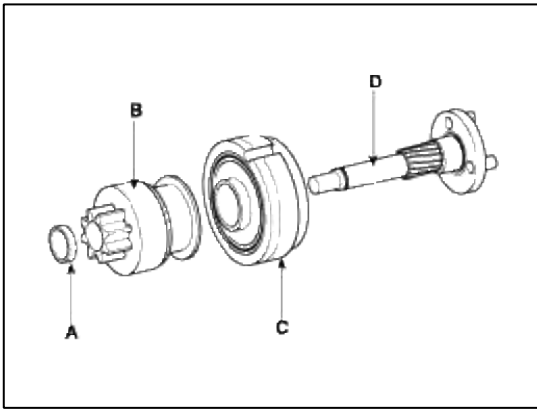
9. Press the stop ring (A) using a socket (B).



10. After removing the stopper (A) using stopper pliers (B).



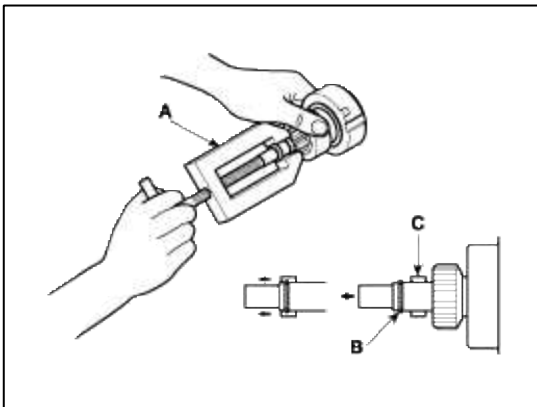
11. Disconnect the stop ring (A), overrunning clutch (B), internal gear (C) and planet shaft (D).



12. Reassembly is the reverse of disassembly.

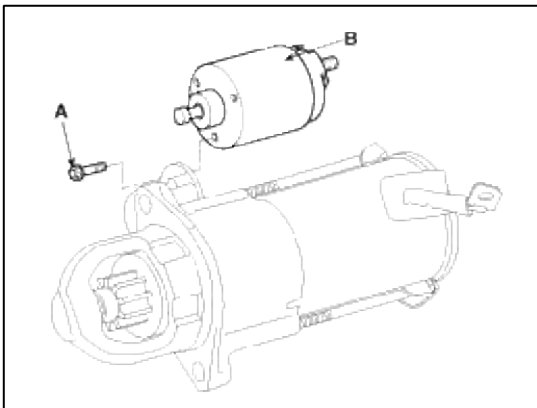
#### NOTE

Using a suitable pulling tool (A), pull the overrunning clutch stop ring (B) over the stopper (C).

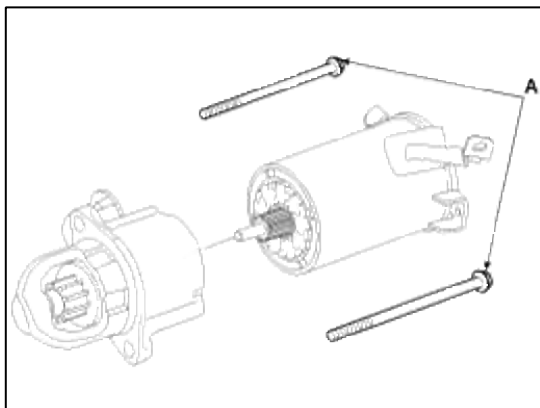


#### DISASSEMBLY

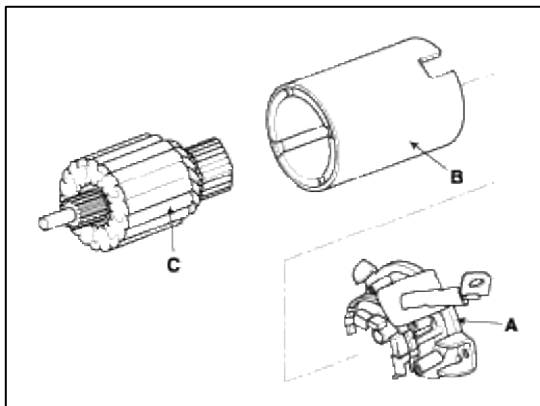
1. Disconnect the M-terminal on the magnet switch assembly.
2. After loosening the 3 screws (A), detach the magnet switch assembly (B).



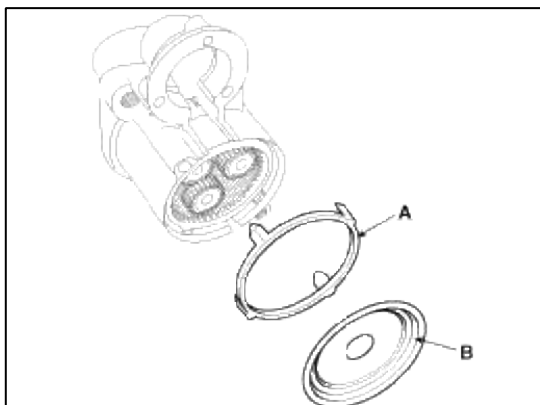
3. Loosen the through bolts (A).



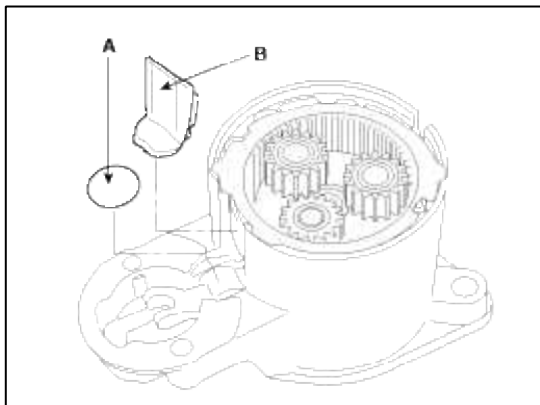
4. Remove the brush holder assembly (A), yoke (b) and armature (C).



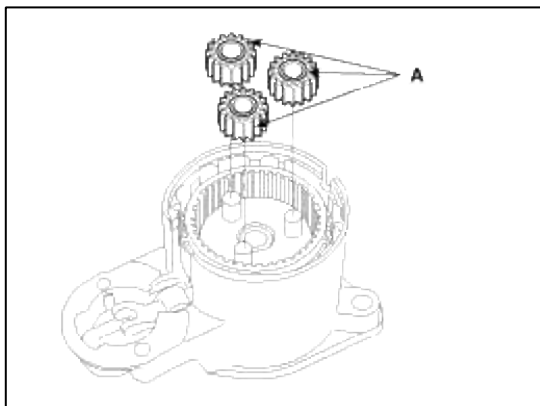
5. Remove the shield (A) and packing (B).



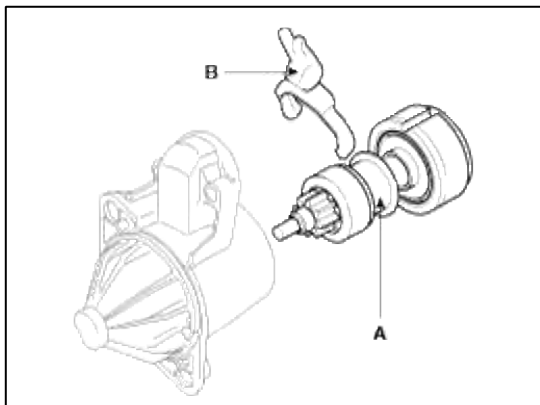
6. Remove the lever plate (A) and lever packing (B).



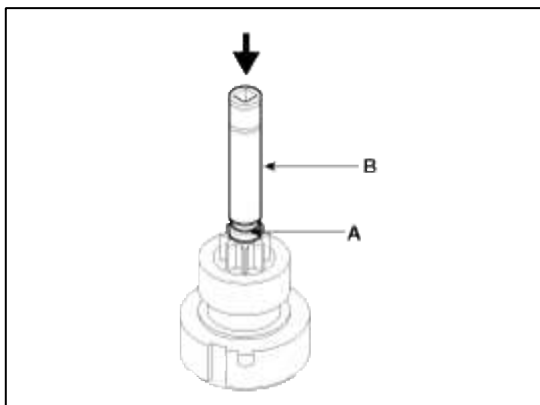
7. Disconnect the planet gear (A).



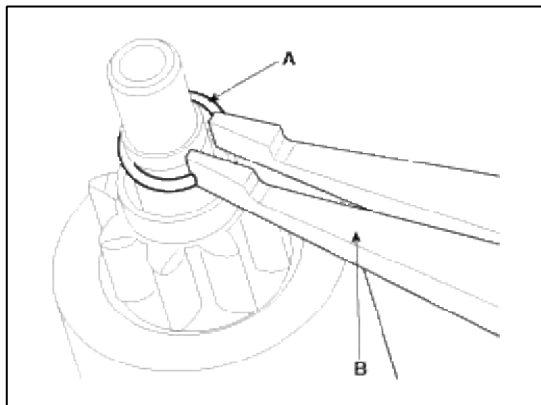
8. Disconnect the planet shaft assembly (A) and lever (B).



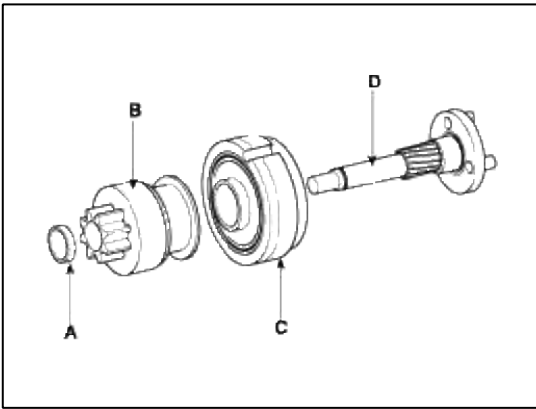
9. Press the stop ring (A) using a socket (B).



10. After removing the stopper (A) using stopper pliers (B).



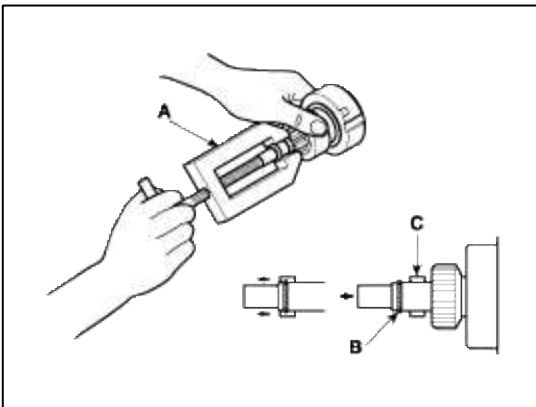
11. Disconnect the stop ring (A), overrunning clutch (B), internal gear (C) and planet shaft (D).



12. Reassembly is the reverse of disassembly.

#### NOTE

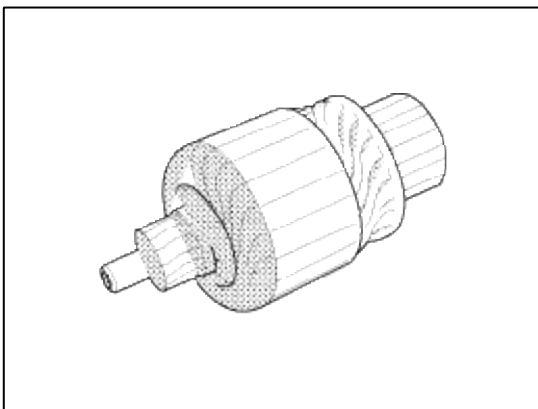
Using a suitable pulling tool (A), pull the overrunning clutch stop ring (B) over the stopper (C).



## INSPECTION

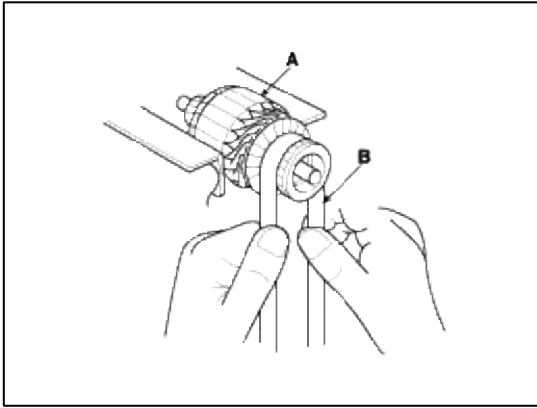
### ARMATURE INSPECTION AND TEST

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.





4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



5. Measure the commutator (A) runout.

- A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.  
 B. If the commutator run out is not within the service limit, replace the armature.

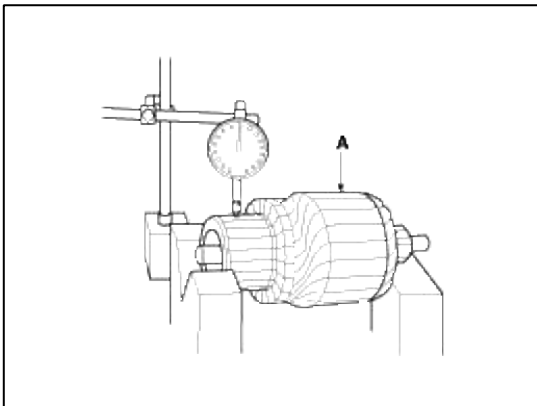
---

#### Commutator runout

Standard (New): 0.02mm (0.0008in.) max

Service limit: 0.05mm (0.0020in.)

---



6. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

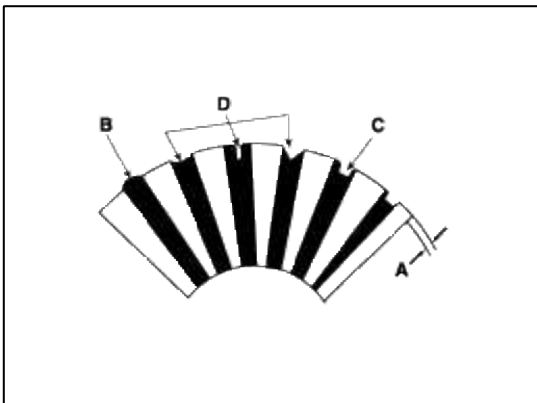
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#### Commutator mica depth

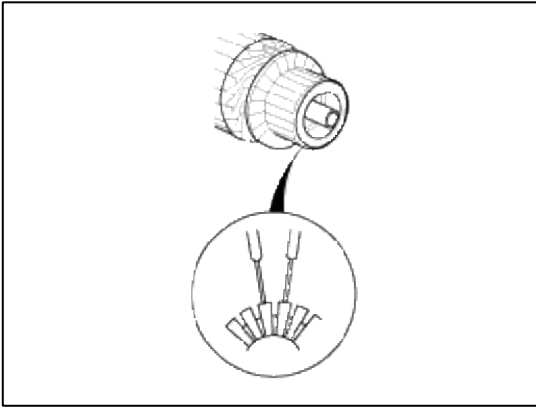
Standard (New) : 0.5 mm (0.0197 in.)

Limit : 0.2mm (0.0079 in.)

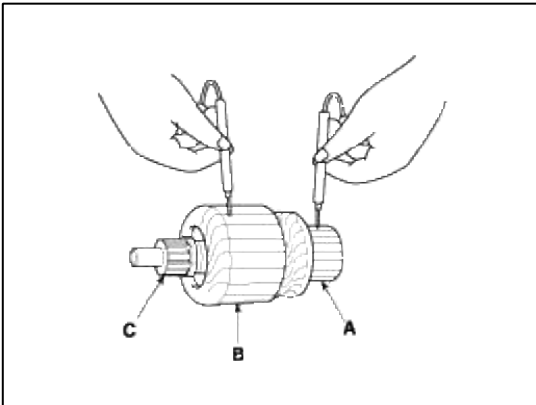
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7. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.

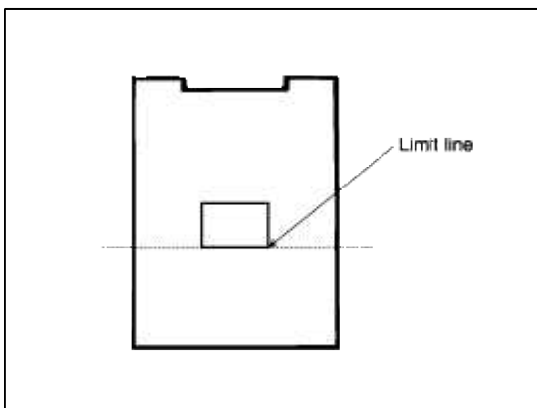


8. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



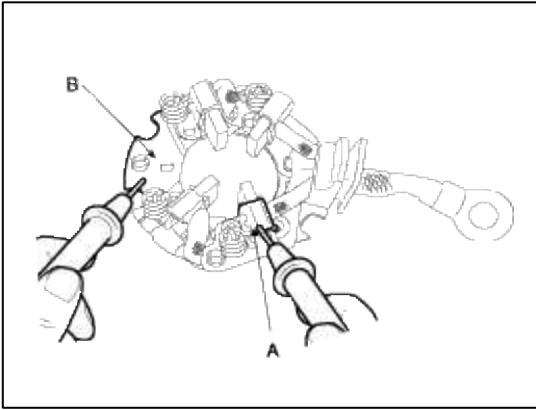
#### INSPECT STARTER BRUSH

Brushes that are worn out, or oil-soaked, should be replaced.

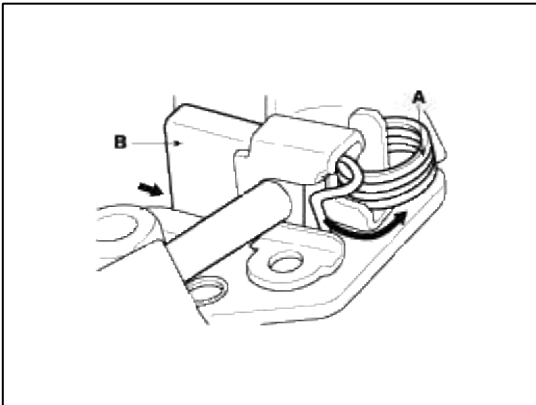


#### STARTER BRUSH HOLDER TEST

1. Check that there is no continuity between the (+) brush holder (A) and (-) brush holder (B). If there is no continuity, replace the brush holder assembly.



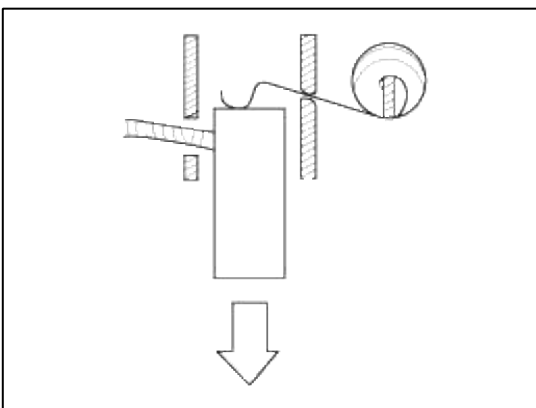
2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.



3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

#### NOTE

To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.

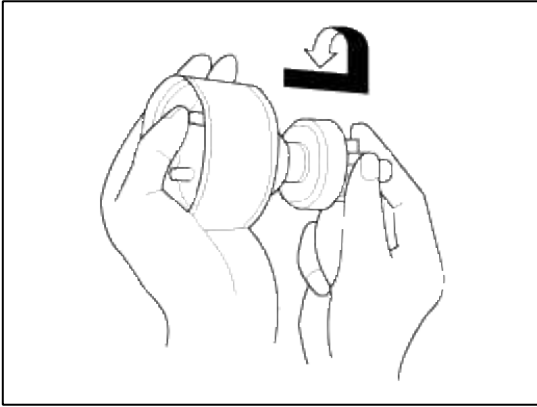


#### OVERRUNNING CLUTCH

1. Slide the overrunning clutch along the shaft.  
Replace it if it does not slide smoothly.

2. Rotate the overrunning clutch both ways.

Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



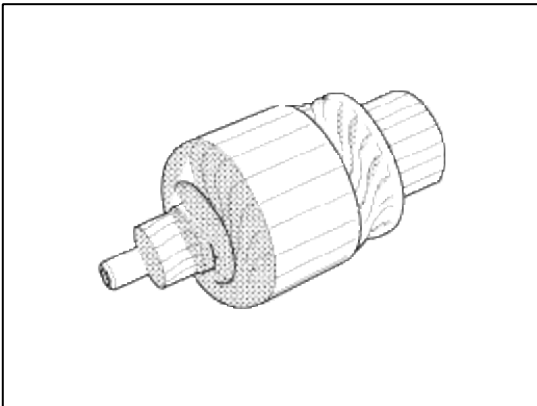
3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).

Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

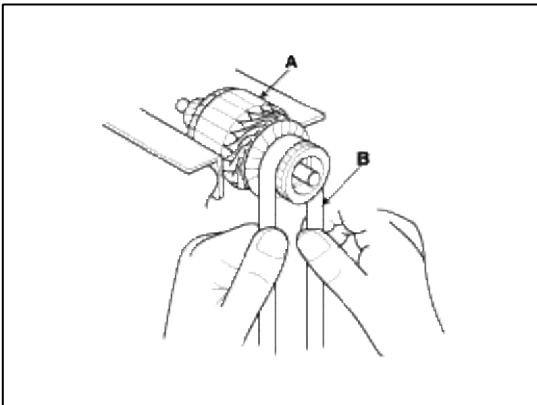
## INSPECTION

### ARMATURE INSPECTION AND TEST

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.



4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



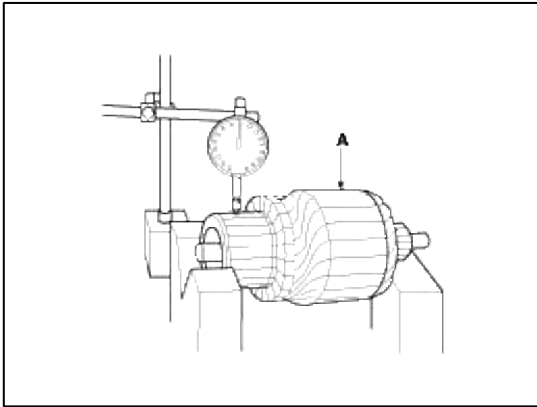
5. Measure the commutator (A) runout.

- A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
- B. If the commutator run out is not within the service limit, replace the armature.

Commutator runout

Standard (New): 0.02mm (0.0008in.) max

Service limit: 0.05mm (0.0020in.)

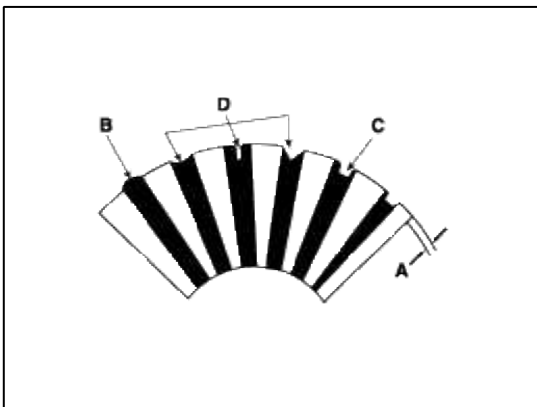


6. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

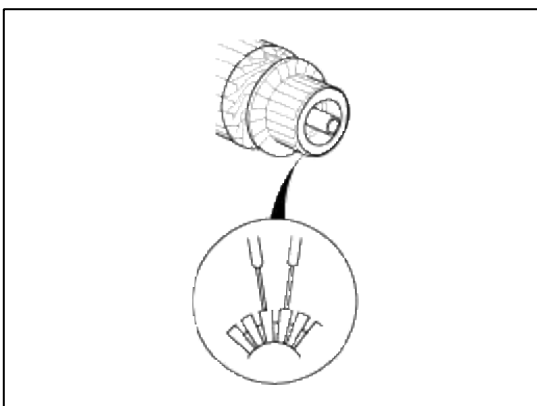
Commutator mica depth

Standard (New) : 0.5 mm (0.0197 in.)

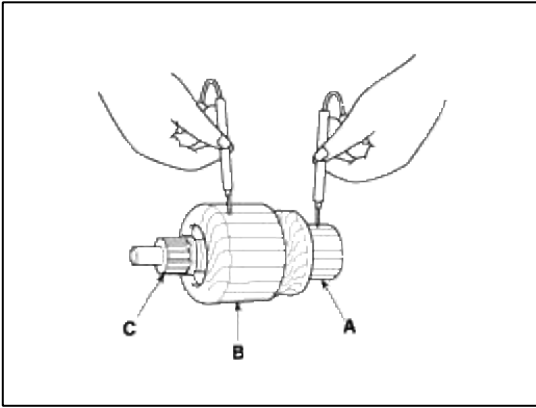
Limit : 0.2mm (0.0079 in.)



7. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.

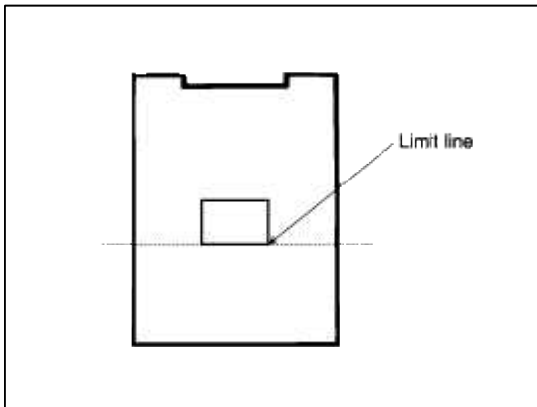


8. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



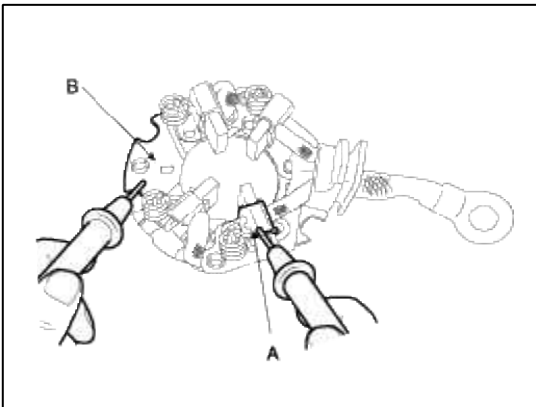
### INSPECT STARTER BRUSH

Brushes that are worn out, or oil-soaked, should be replaced.

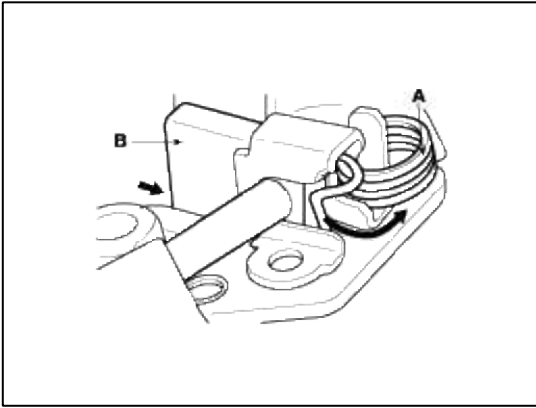


### STARTER BRUSH HOLDER TEST

1. Make sure there is no continuity between the (+) brush holder (A) and (-) plate (B). If there is continuity, replace the brush holder assembly.



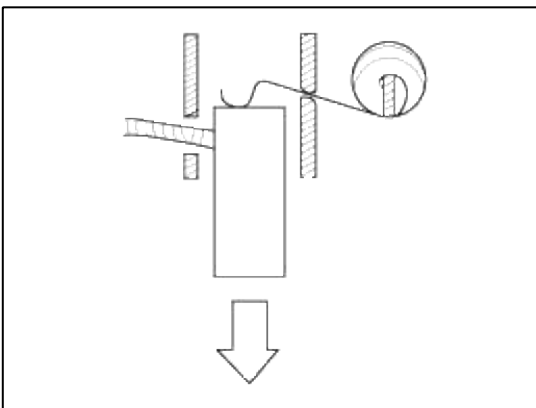
2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.



3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

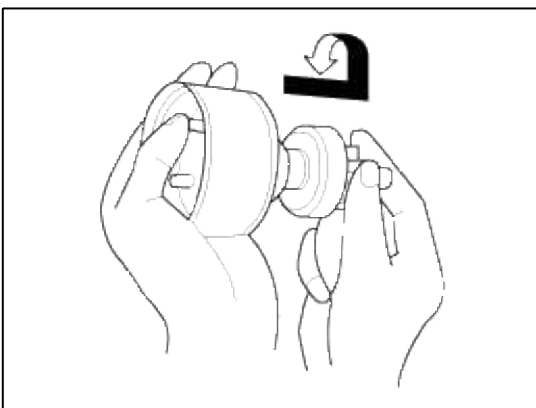
#### NOTE

To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.



### OVERRUNNING CLUTCH

1. Slide the overrunning clutch along the shaft.  
Replace it if it does not slide smoothly.
2. Rotate the overrunning clutch both ways.  
Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).

Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

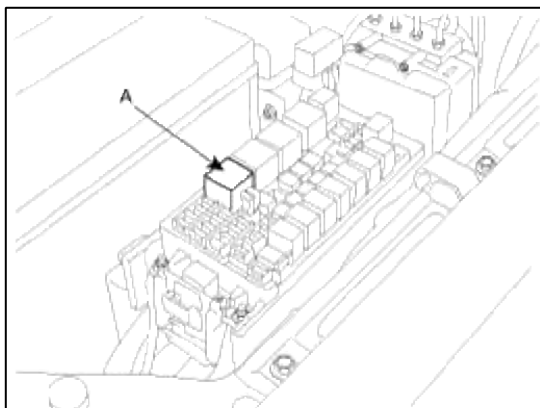
## CLEANING

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

## Engine Electrical System > Starting System > Starter Relay > Repair procedures

### INSPECTION

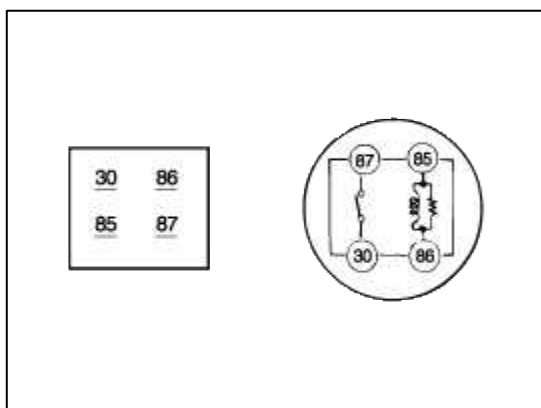
1. Remove the fuse box cover.
2. Remove the starter relay (A).



3. Using an ohmmeter, check that there is continuity between each terminal.

Terminal	Continuity
30 - 87	NO
85 - 86	YES

4. Apply 12V to terminal 85 and ground to terminal 86.  
Check for continuity between terminals 30 and 87.



5. If there is no continuity, replace the starter relay.
6. Install the starter relay.
7. Install the fuse box cover.

## Engine Electrical System > Starting System > Description and Operation

### DESCRIPTION

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.

When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.



The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.

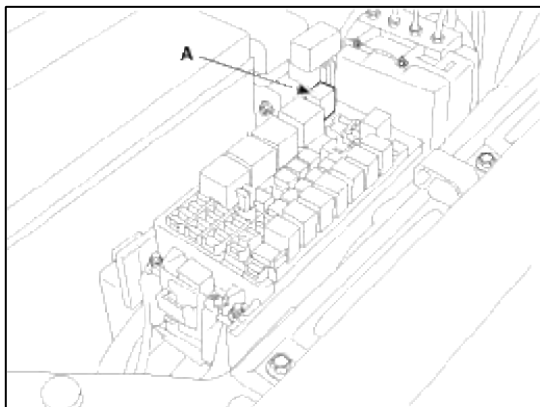
## Engine Electrical System > Starting System > Repair procedures

### TROUBLESHOOTING STARTER CIRCUIT

#### NOTE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay(A) from the fuse box.

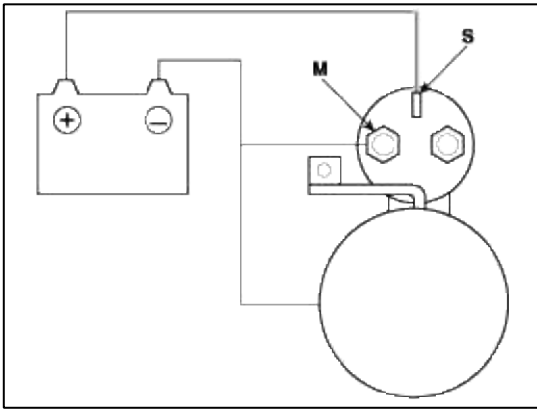


2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START"  
 If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.  
 If it won't disengage from the ring gear when you release key, check for the following until you find the cause.  
 A. Solenoid plunger and switch malfunction.  
 B. Dirty pinion gear or damaged overrunning clutch.
3. Check the battery condition. Check electrical connections at the battery, battery negative cable connected to the body, engine ground cables, and the starter for looseness and corrosion. Then try starting the engine again.  
 If the starter cranks normally the engine, repairing the loose connection repaired the problem. The starting system is now OK.  
 If the starter still does not crank the engine, go to next step.
4. Disconnect the connector from the S-terminal of solenoid. Connect a jumper wire from the B-terminal of solenoid to the S-terminal of solenoid.  
 If the starter cranks the engine, go to next step.  
 If the starter still does not crank the engine, remove the starter, and repair or replace as necessary.
5. Check the following items in the order listed until you find the open circuit.  
 A. Check the wire and connectors between the driver's under-dash fuse/relay box and the ignition switch, and between the driver's under-dash fuse/relay box and the starter.  
 B. Check the ignition switch (Refer to BE group - ignition system)  
 C. Check the transaxle range switch connector or ignition lock switch connector.  
 D. Inspect the starter relay.

### STARTER SOLENOID TEST

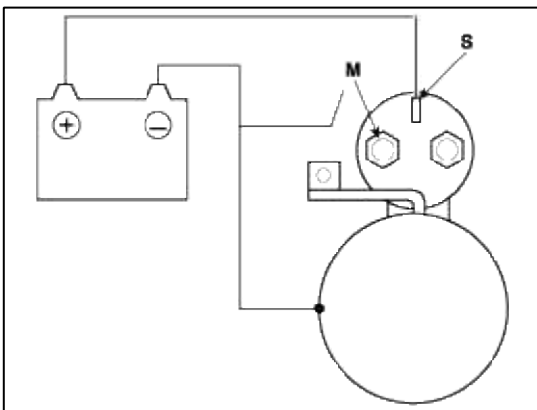
1. Disconnect the field coil wire from the M-terminal of solenoid switch.

2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.

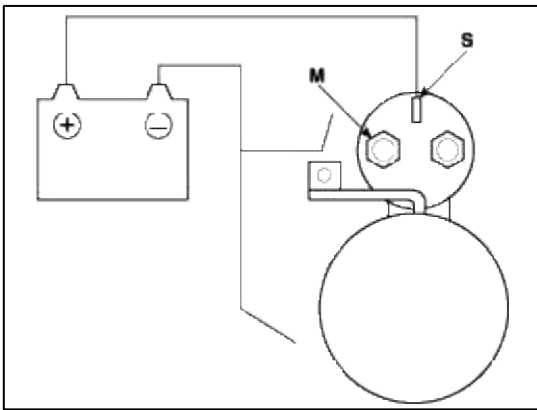


3. Disconnect the battery from the M terminal.

If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



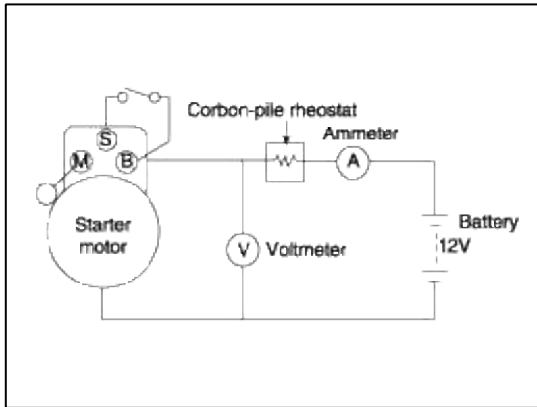
4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



#### FREE RUNNING TEST

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostats as shown in the illustration.

3. Connect a voltmeter (15-volt scale) across starter motor.



4. Rotate carbon pile to the off position.

5. Connect the battery cable from battery's negative post to the starter motor body.

6. Adjust until battery voltage shown on the voltmeter reads 11 volts.

7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

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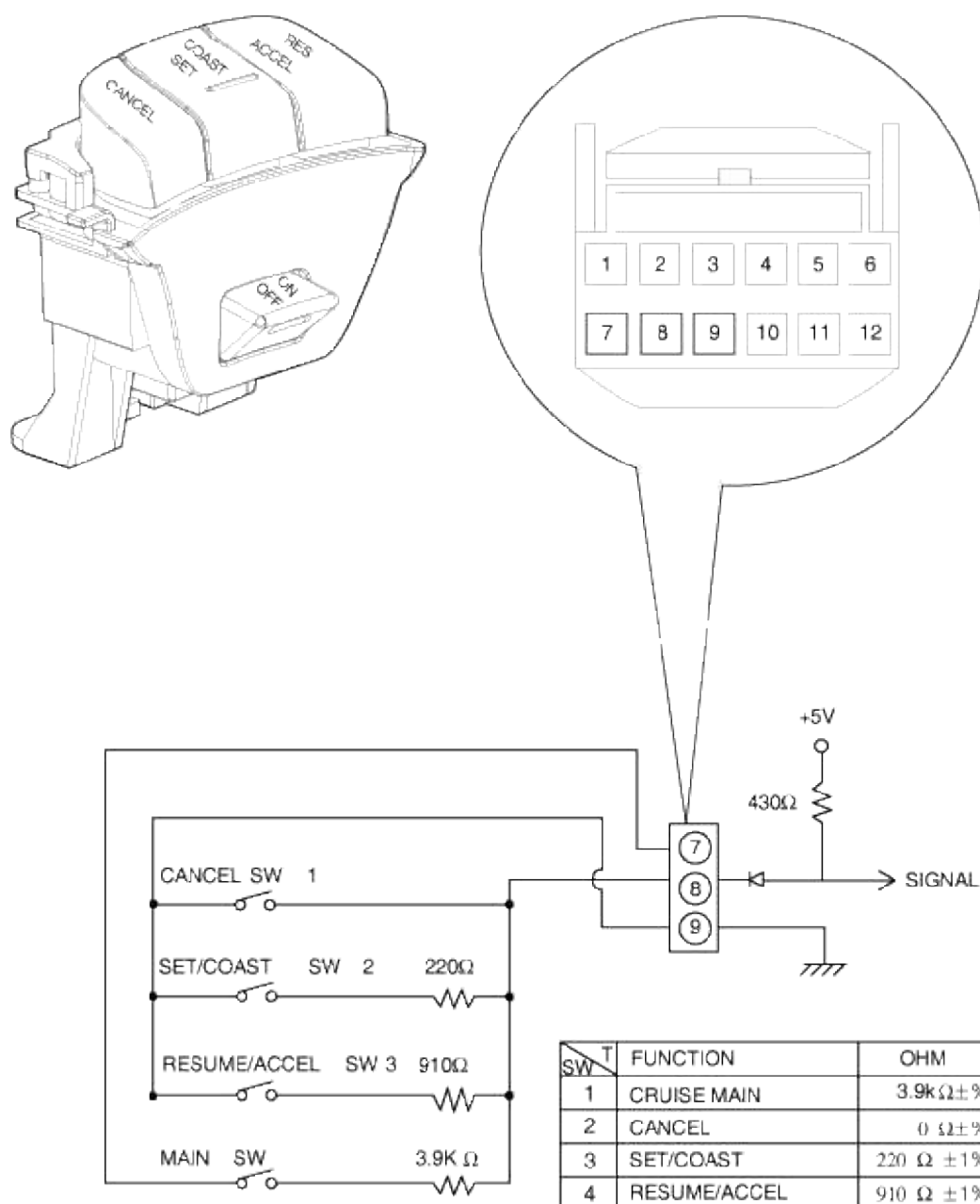
Current : 85A MAX

Speed : 2,600 rpm MIN

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**Engine Electrical System > Cruise Control System > Cruise Control Switch > Schematic Diagrams**

CIRCUIT DIAGRAM

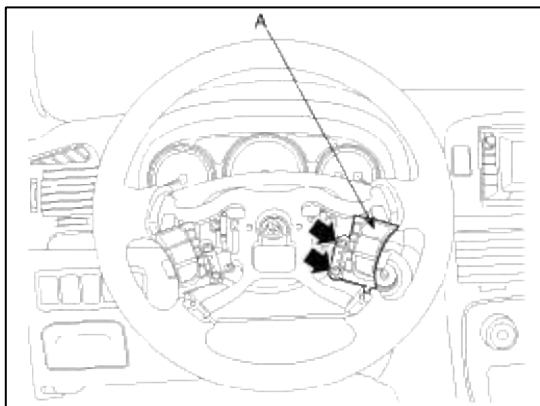


## Engine Electrical System > Cruise Control System > Cruise Control Switch > Repair procedures

### REMOVAL

1. Disconnect the battery (-) terminal.
2. Remove the driver side air bag module. (Refer to RT GR.)

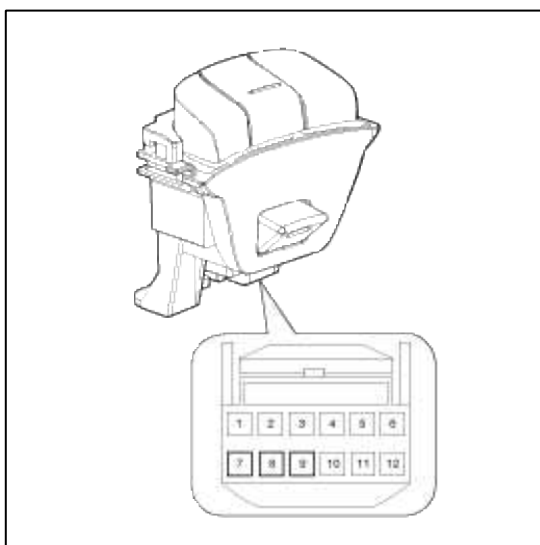
3. Disconnect the cruise control switch connector and then remove the cruise control switch(A) with two screws.



4. Installation is the reverse of removal.

## MEASURING RESISTANCE

1. Disconnect the cruise control switch connector from the control switch.



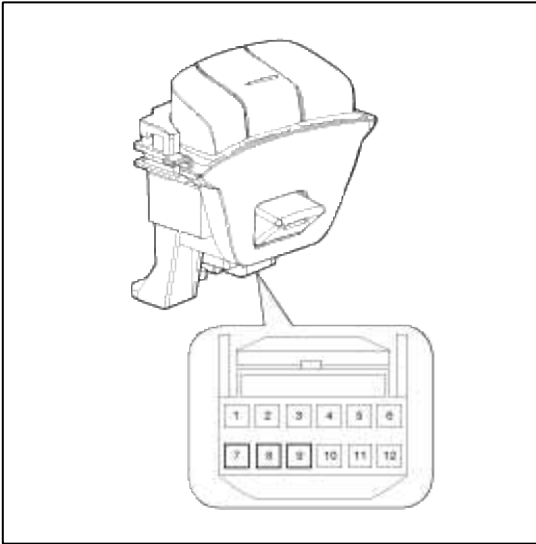
2. Measure resistance between terminals on the control switch when each function switch is ON (switch is depressed).

Function switch	Terminal	Resistance
Cruise Main	7-9	$3.9\text{k}\Omega \pm 1\%$
Cancel	8-9	$0\Omega \pm 1\%$
Set/Coast	8-9	$220\Omega \pm 1\%$
Resume/Accel	8-9	$910\Omega \pm 1\%$

3. If not within specification, replace switch.

## MEASURING VOLTAGE

1. Connect the cruise control switch connector to the control switch.



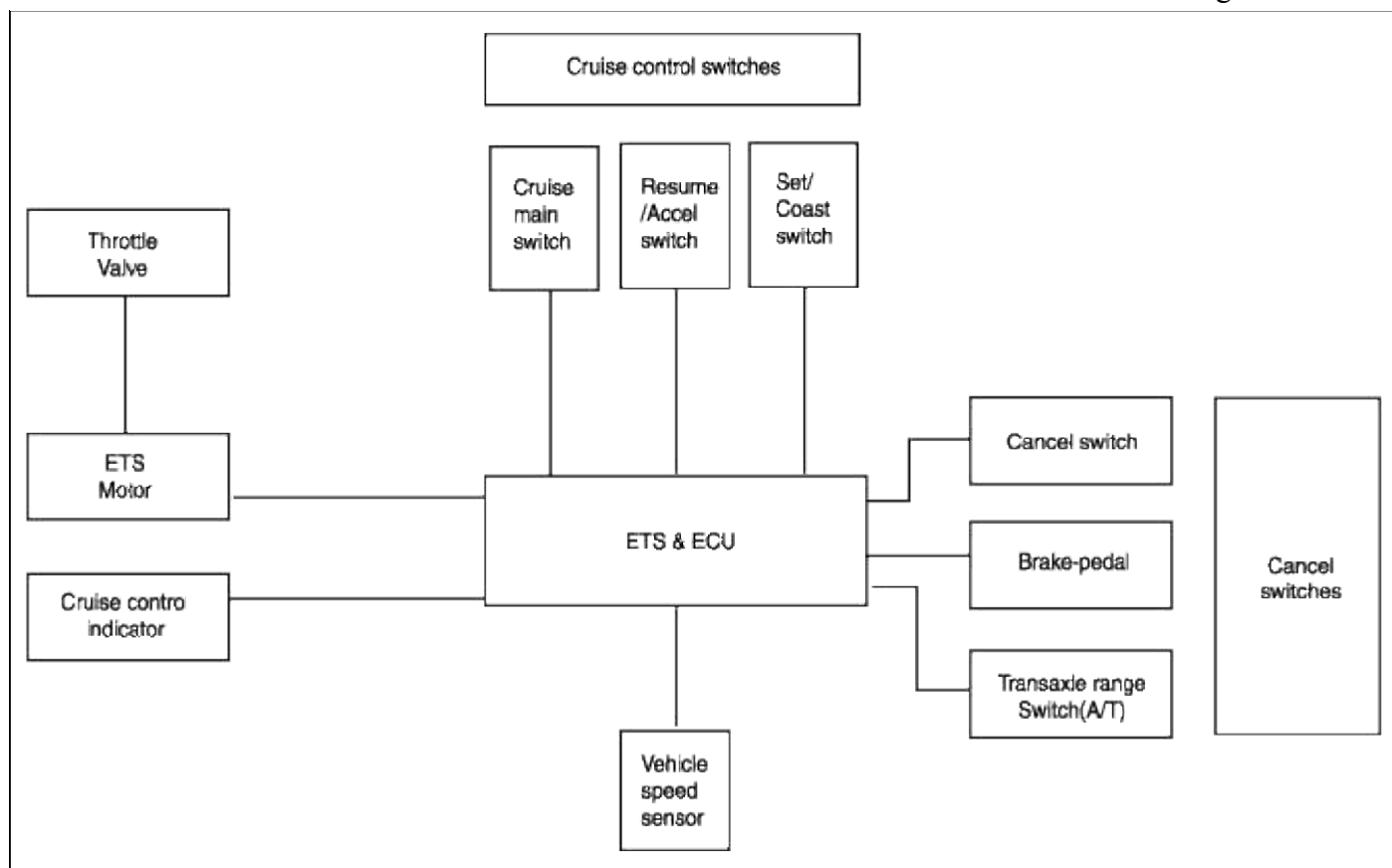
2. Measure voltage between terminals on the harness side connector when each function switch is ON (switch is depressed).

Function switch	Terminal	Voltage
Cruise Main	7-9	-
Cancel	8-9	$0.0V \pm 0.25V$
Set/Coast	8-9	$1.5V \pm 0.25V$
Resume/Accel	8-9	$3.0V \pm 0.25V$

3. If not within specification, replace switch.

### Engine Electrical System > Cruise Control System > Description and Operation

#### SYSTEM BLOCK DIAGRAM



### COMPONENT PARTS AND FUNCTION OUTLINE

Component part		Function
Vehicle-speed sensor		Converts vehicle speed to pulse.
Engine control module (ECM)		Receives signals from sensor and control switches;
Cruise control indicator		Illuminate when CRUISE main switch is ON (Built into cluster)
Cruise Control switches	CRUISE main switch	Switch for automatic speed control power supply.
	Resume/Accel switch	Controls automatic speed control functions by Resume/Accel switch (Set/Coast switch)
	Set/Coast switch	
Cancel switch	Cancel switch	Sends cancel signals to ECM
	Brake-pedal switch	
	Transaxle range switch (A/T)	
	Clutch switch (M/T)	
ETS motor		Regulates the throttle valve to the set opening by ECM.

\* ETS : Electronic Throttle System

### CRUISE CONTROL

Cruise control system is engaged by "ON/OFF" main switch located on right of steering wheel column. System has the capability to cruise, coast, resume speed, and accelerate, and raise "tab-up" or lower "tab-down" set speed. It also has a safety interrupt, engaged upon depressing brake or shifting select lever.

ECM is a speed control system that maintains a required vehicle speed at normal driving conditions.

The main components of cruise control system are mode control switches, transaxle range switch, brake switch, vehicle speed sensor, ECM and ETS motor that connect throttle body.

ECM contains a low speed limit which will prevent system engagement below a minimum speed of 40km/h (25mph).

The operation of the controller is controlled by mode control switches located on steering wheel.

Transaxle range switch and brake switch are provided to disengage the cruise control system. The switches are on brake pedal bracket and transaxle. When the brake pedal is depressed or select lever shifted, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

#### **Cruise main switch**

Cruise control system is engaged by pressing "ON/OFF" push button. Releasing "ON/OFF" push button release throttle, clears cruise memory speed, and puts vehicle in a non-cruise mode.

#### **Coast/Set switch**

COAST/SET switch located on right of steering wheel column has two positions - "Normal" and "Depressed". The set position - With COAST/SET switch depressed and then released the cruise speed will be set at the speed the vehicle was going when COAST/SET switch was released. The coast position - With COAST/SET switch fully depressed, driver can lower cruise speed. To decrease cruise speed, COAST/SET switch is held in, disengaging cruise control system. When vehicle has slowed to required cruise speed, releasing COAST/SET switch will re-engage speed at new selected speed.

The tab down - To lower vehicle speed, cruise must be engaged and operating. Tab down is done by quickly pressing and releasing COAST/SET switch. Do not hold COAST/SET switch in depressed position.

Tab down is a function which will cause the cruise control's speed of vehicle to decrease by 1 mph (1.6km/h)

#### **Resume/Accel switch**

RES/ACCEL switch located on right of steering wheel column has two positions - "Normal" and "Depressed".

The resume position - With RES/ACCEL switch depressed and then release, this switch also returns cruise control operation to last speed (Which is temporarily disengaged by Cancel switch or Brake pedal), setting when momentarily operating RES/ACCEL switch by constant acceleration.

The accel position - With RES/ACCEL switch depressed and held in, disengaging cruise control system, when vehicle has accelerated to required cruise speed, releasing RES/ACCEL switch will re-engage speed at new selected speed.

The tab up - To increase vehicle speed, the cruise must be engaged and operating.

Tab up is done by quickly pressing and releasing RES/ACCEL switch less than 0.5 second. Do not hold RES/ACCEL switch in depressed position. Tab up is a function in which cruise speed can be increased by 1mph (1.6km/h).

#### **Cancel switch**

Cruise control system is temporarily disengaged by pressing "CANCEL" switch.

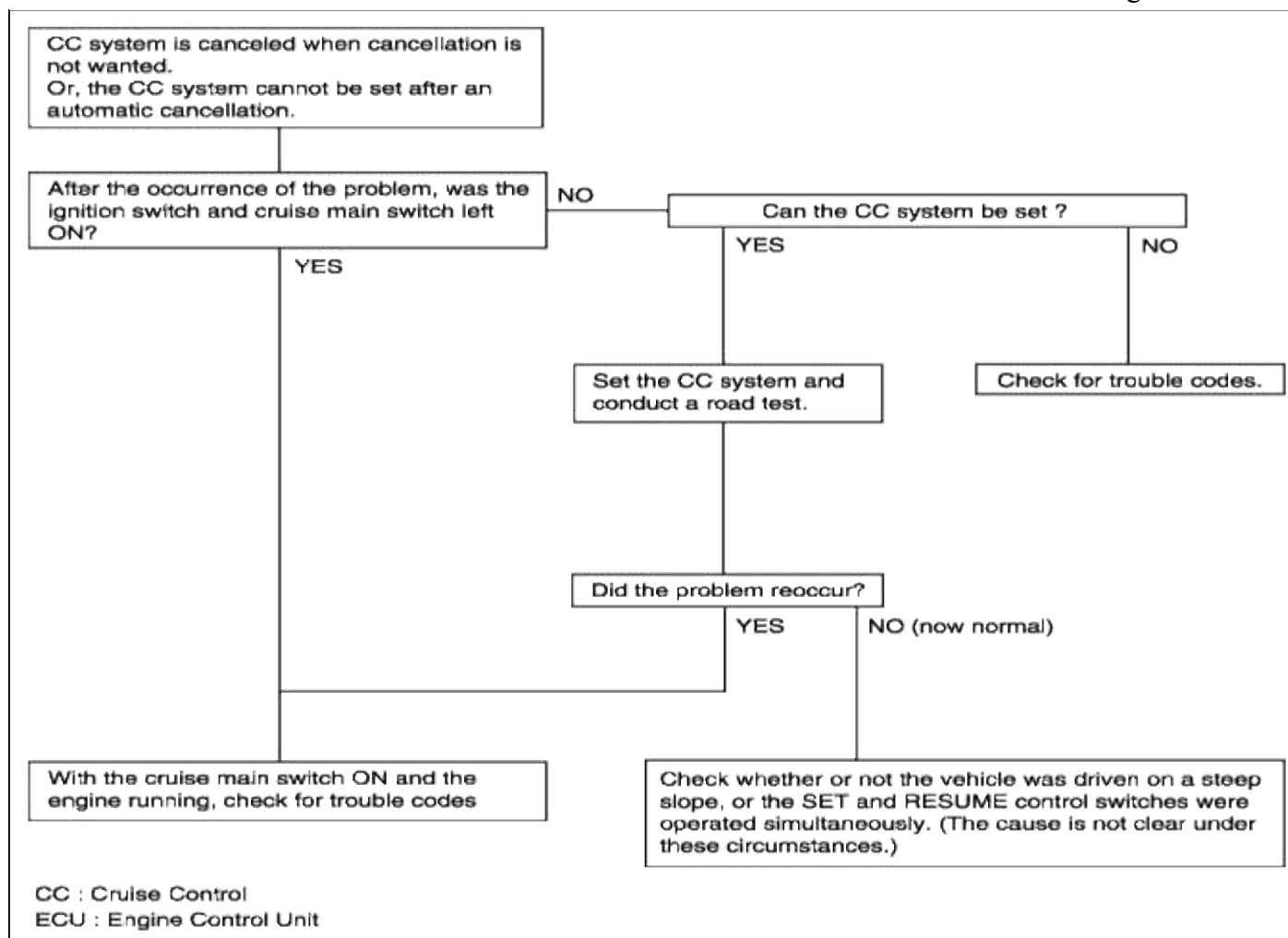
Cruise speed canceled by this switch will be recovered by RES/ACCEL switch

### **Engine Electrical System > Cruise Control System > Troubleshooting**

#### **TROUBLE SYMPTOM CHARTS**

##### **TROUBLE SYMPTOM 1**





## TROUBLE SYMPTOM 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of ECM	Check input and output signals at ECM

## TROUBLE SYMPTOM 3

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the brake pedal is depressed	Damaged or disconnected wiring of the brake pedal switch	Repair the harness or replace the brake pedal switch
	Malfunction of the ECM signals	Check input and output signals at ECM

## TROUBLE SYMPTOM 4

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the shift lever is moved to the "N" position (It is canceled, however, when the brake pedal is depressed)	Damaged or disconnected wiring of inhibitor switch input circuit	Repair the harness or repair or replace the inhibitor switch
	Improper adjustment of inhibitor switch	
	Malfunction of the ECM signals	Check input and output signals at ECM

**TROUBLE SYMPTOM 5**

Trouble symptom	Probable cause	Remedy
Cannot decelerate (coast) by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	Repair the harness or replace the SET switch
	Malfunction of the ECM signals	Check input and output signals at ECM

**TROUBLE SYMPTOM 6**

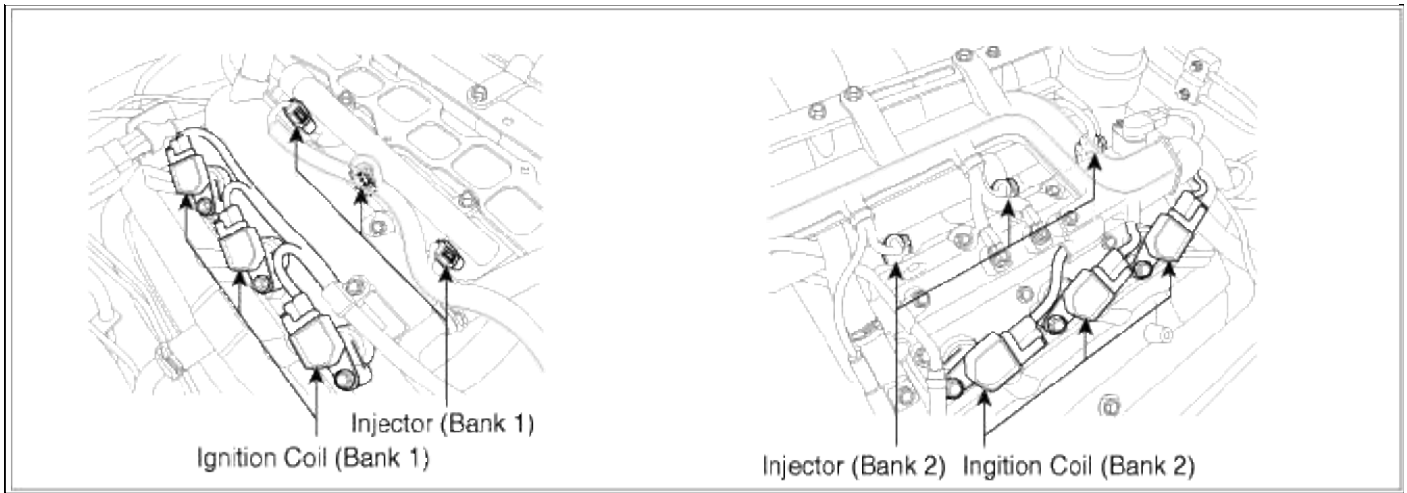
Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the RESUME switch	Damaged or disconnected wiring, or short circuit, or RESUME switch input circuit	Repair the harness or replace the RESUME switch
	Malfunction of the ECM signals	Check input and output signals at ECM

**TROUBLE SYMPTOM 7**

Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the ECM signals	Check input and output signals at ECM

**TROUBLE SYMPTOM 8**

Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	



### GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

### DTC DESCRIPTION

The ECM measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred. When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. ECM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indicator Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Individual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., ECM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

### DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC strategy		<ul style="list-style-type: none"> <li>Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Spark plugs</li> <li>Faulty Spark plug cables</li> <li>Air Leakage</li> <li>Belt deflection and Air gap of CKPS</li> <li>Incorrect timing</li> <li>Faulty injector</li> <li>Improper fuel pressure</li> <li>Improper engine compression</li> <li>Faulty ECM</li> </ul>
Enable condition		No disabling faults present / No disabling Active Faults <ul style="list-style-type: none"> <li>P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295</li> <li>P0103 / P0102 / P0108 / P0107 / P0106 / P0501</li> <li>Engine speed between 550 and 5800 RPM</li> <li>System voltage between 9 and 18 volts</li> <li>The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)</li> </ul>	
Threshold Value	Case 1	<ul style="list-style-type: none"> <li>Individual cylinder misfire detection</li> </ul>	
	Case 2	<ul style="list-style-type: none"> <li>Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)</li> </ul>	
	Case 3	<ul style="list-style-type: none"> <li>Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)</li> </ul>	
Diagnosis time		<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
MIL ON condition		<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu.
- (4) Read "DTC Status" parameter.

<b>1.1 DIAGNOSTIC TROUBLE CODES</b> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>		<b>PXXXX TITLE</b>  <b>1.MIL STATUS: ON/OFF</b> <b>2.DTC STATUS: PRESENT/HISTORY</b> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b>  <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b>
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(5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced w/ condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

## SYSTEM INSPECTION

### 1. Check Spark Plug

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Air Leakage " as indicated below

### 2. Check Air Leakage

(1) Visually/physically inspect the intake/exhaust system as following items,

- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

### 3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by pulling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from port "A" and verify that air comes out of port "B"

(6) Blow through valve from port "B" and verify that no air comes out of port "A"

(7) Has a problem been found ?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Compression pressure" as indicated below

## 4. Check Compression pressure

- (1) Warm up the engine to normal operating temperature
- (2) Disconnect the spark plug cables and remove the spark plugs.
- (3) Crank the engine to remove any foreign material in the cylinders.
- (4) Put compression pressure gauge into spark plug hole
- (5) Crank the engine at wide open throttle and check compression pressure at each cylinder
- (6) Is compression pressure for each cylinder displayed within specifications ?

Specification : 1323kPa(13.5 kg/cm<sup>2</sup>,192 psi)

**YES**

Go to "Check Timing " as indicated below

**NO**

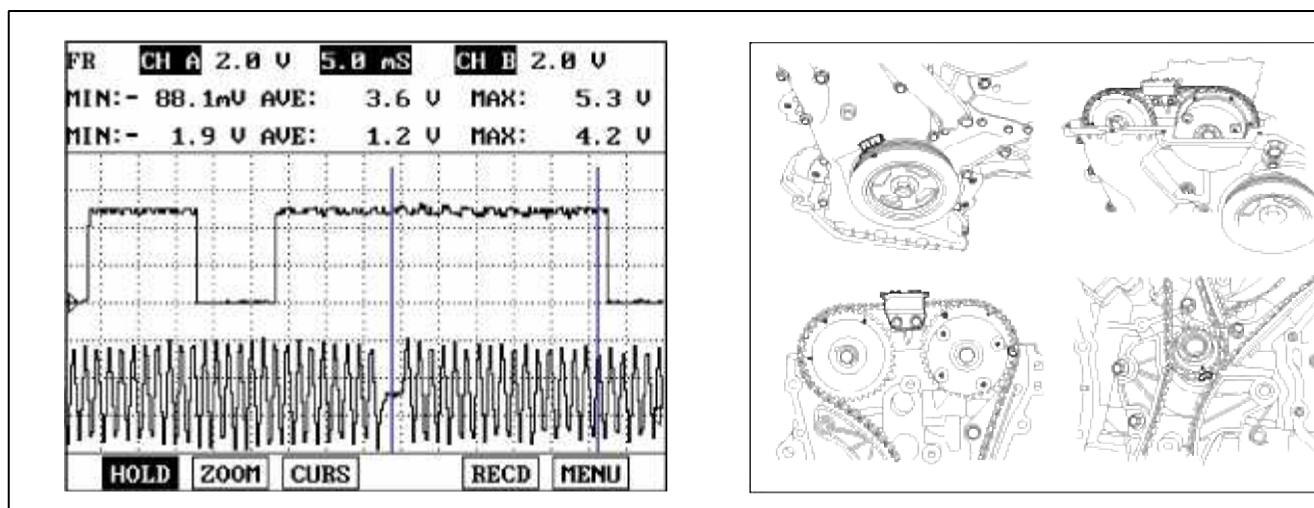
Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

## 5. Check Timing

- (1) Ignition "OFF"
- (2) Check for correct alignment of CMP and CKP signals.

Reference : The 17th of CKP signal from missing tooth is aligned with high of CMP signal



- (3) Are all timing marks aligned correctly ?

**YES**

Go to "Check Fuel Pressure" as indicated below

**NO**

Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

## 6. Check Fuel Pressure

**NOTE**

1. Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
2. The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- (2) Start the engine and wait until the engine stalls.
- (3) IG "OFF" and connect Fuel Pump Relay.
- (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- (6) Measure the fuel pressure at idle.

---

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm<sup>2</sup>, 54.3 ~ 55.8 psi)

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- (7) Is the measured fuel pressure within specifications ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe

### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

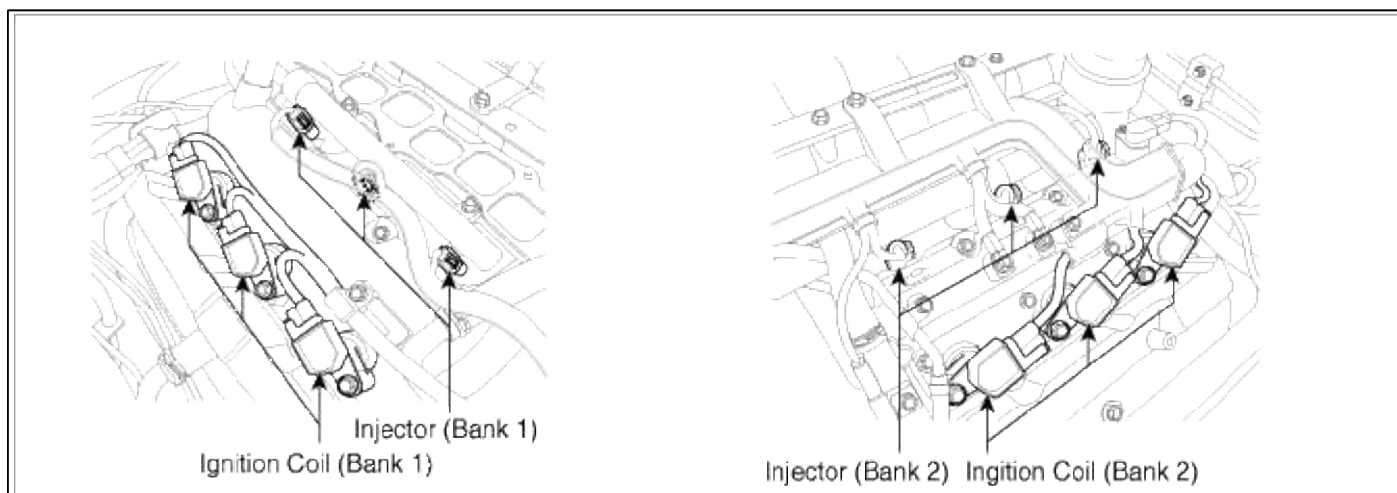
**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## COMPONENT LOCATION



## GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

## DTC DESCRIPTION

The ECM measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred. When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. ECM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indicator Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Individual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., ECM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

## DTC DETECTING CONDITION



Item		Detecting Condition	Possible Cause
DTC strategy		<ul style="list-style-type: none"> <li>Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Spark plugs</li> <li>Faulty Spark plug cables</li> <li>Air Leakage</li> <li>Belt deflection and Air gap of CKPS</li> <li>Incorrect timing</li> <li>Faulty injector</li> <li>Improper fuel pressure</li> <li>Improper engine compression</li> <li>Faulty ECM</li> </ul>
Enable condition		No disabling faults present / No disabling Active Faults <ul style="list-style-type: none"> <li>P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295</li> <li>P0103 / P0102 / P0108 / P0107 / P0106 / P0501</li> <li>Engine speed between 550 and 5800 RPM</li> <li>System voltage between 9 and 18 volts</li> <li>The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)</li> </ul>	
Threshold Value	Case 1	<ul style="list-style-type: none"> <li>Individual cylinder misfire detection</li> </ul>	
	Case 2	<ul style="list-style-type: none"> <li>Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)</li> </ul>	
	Case 3	<ul style="list-style-type: none"> <li>Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)</li> </ul>	
Diagnosis time		<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
MIL ON condition		<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu.
- (4) Read "DTC Status" parameter.

<b>1.1 DIAGNOSTIC TROUBLE CODES</b> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>		<b>PXXXX TITLE</b>  <b>1.MIL STATUS: ON/OFF</b> <b>2.DTC STATUS: PRESENT/HISTORY</b> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b>  <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b>
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(5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced w/ condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

## SYSTEM INSPECTION

### 1. Check Spark Plug

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Air Leakage " as indicated below

### 2. Check Air Leakage

(1) Visually/physically inspect the intake/exhaust system as following items,

- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

### 3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by pulling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from port "A" and verify that air comes out of port "B"

(6) Blow through valve from port "B" and verify that no air comes out of port "A"

(7) Has a problem been found ?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Compression pressure" as indicated below

#### 4. Check Compression pressure

- (1) Warm up the engine to normal operating temperature
- (2) Disconnect the spark plug cables and remove the spark plugs.
- (3) Crank the engine to remove any foreign material in the cylinders.
- (4) Put compression pressure gauge into spark plug hole
- (5) Crank the engine with widely open throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm<sup>2</sup>,192 psi)

- (6) Is compression pressure for each cylinder displayed within specifications ?

**YES**

Go to "Check Timing " as indicated below

**NO**

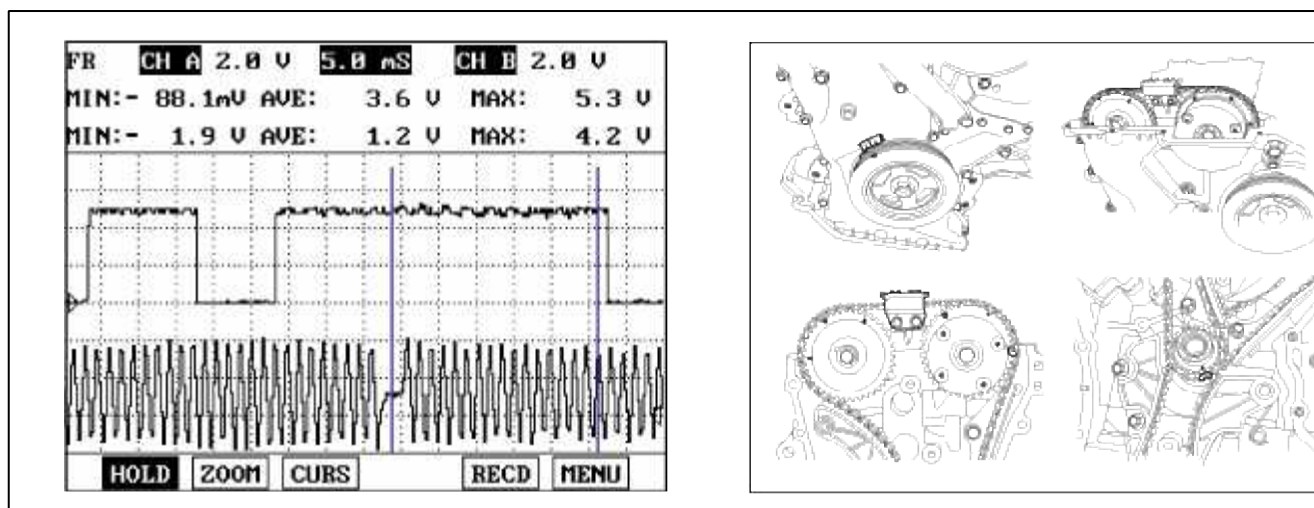
Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

#### 5. Check Timing

- (1) Ignition "OFF"
- (2) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly aligned.

Reference : The 17th of CKP signal from missing tooth is aligned with high of CMP signal



- (3) Are all timing marks aligned correctly ?

**YES**

Go to "Check Fuel Pressure" as indicated below

**NO**

Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

## 6. Check Fuel Pressure

**NOTE**

1. Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
2. The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- (2) Start-up and wait until it stops itself.
- (3) IG "OFF" and connect Fuel Pump Relay.
- (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- (6) Measure the fuel pressure at idle.

---

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm<sup>2</sup>, 54.3 ~ 55.8 psi)

---

- (7) Is the measured fuel pressure within specifications ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

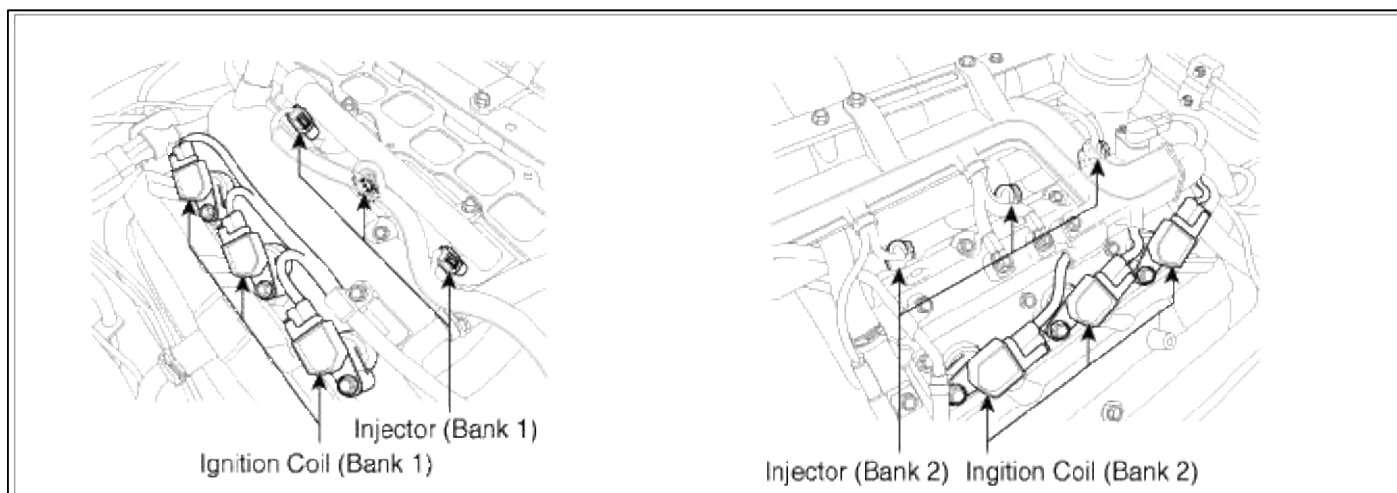
**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## COMPONENT LOCATION



## GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

## DTC DESCRIPTION

The ECM measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred. When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire causes a loss of torque produced from that cylinder, ECM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indicator Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Individual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., ECM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

## DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC strategy		<ul style="list-style-type: none"> <li>Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Spark plugs</li> <li>Faulty Spark plug cables</li> <li>Air Leakage</li> <li>Belt deflection and Air gap of CKPS</li> <li>Incorrect timing</li> <li>Faulty injector</li> <li>Improper fuel pressure</li> <li>Improper engine compression</li> <li>Faulty ECM</li> </ul>
Enable condition		No disabling faults present / No disabling Active Faults <ul style="list-style-type: none"> <li>P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295</li> <li>P0103 / P0102 / P0108 / P0107 / P0106 / P0501</li> <li>Engine speed between 550 and 5800 RPM</li> <li>System voltage between 9 and 18 volts</li> <li>The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)</li> </ul>	
Threshold Value	Case 1	<ul style="list-style-type: none"> <li>Individual cylinder misfire detection</li> </ul>	
	Case 2	<ul style="list-style-type: none"> <li>Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)</li> </ul>	
	Case 3	<ul style="list-style-type: none"> <li>Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)</li> </ul>	
Diagnosis time		<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
MIL ON condition		<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu.
- (4) Read "DTC Status" parameter.

<div>1.1 DIAGNOSTIC TROUBLE CODES</div> <div>PXXXX DTC TITLE</div> <div>NUMBER OF DTC : 1 ITEMS</div> <div> <div>PART</div> <div>ERAS</div> <div>DTAL</div> </div>	<div>PXXXX TITLE</div> <div> 1.MIL STATUS: ON/OFF  2.DTC STATUS: PRESENT/HISTORY  3.DIAG.STATUS: DIAGNOSIS FINISHED </div> <div>DTC CAUSE TO SYSTEM ERROR : PXXXX</div>
--	---

(5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced w/ condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

## SYSTEM INSPECTION

### 1. Check Spark Plug

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Air Leakage " as indicated below

### 2. Check Air Leakage

(1) Visually/physically inspect the intake/exhaust system as following items,

- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

### 3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by pulling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from port "A" and verify that air comes out of port "B"

(6) Blow through valve from port "B" and verify that no air comes out of port "A"

(7) Has a problem been found ?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Compression pressure" as indicated below

#### 4. Check Compression pressure

- (1) Warm up the engine to normal operating temperature
- (2) Disconnect the spark plug cables and remove the spark plugs.
- (3) Crank the engine to remove any foreign material in the cylinders.
- (4) Put compression pressure gauge into spark plug hole
- (5) Crank the engine with widely open throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm<sup>2</sup>,192 psi)

- (6) Is compression pressure for each cylinder displayed within specifications ?

**YES**

Go to "Check Timing " as indicated below

**NO**

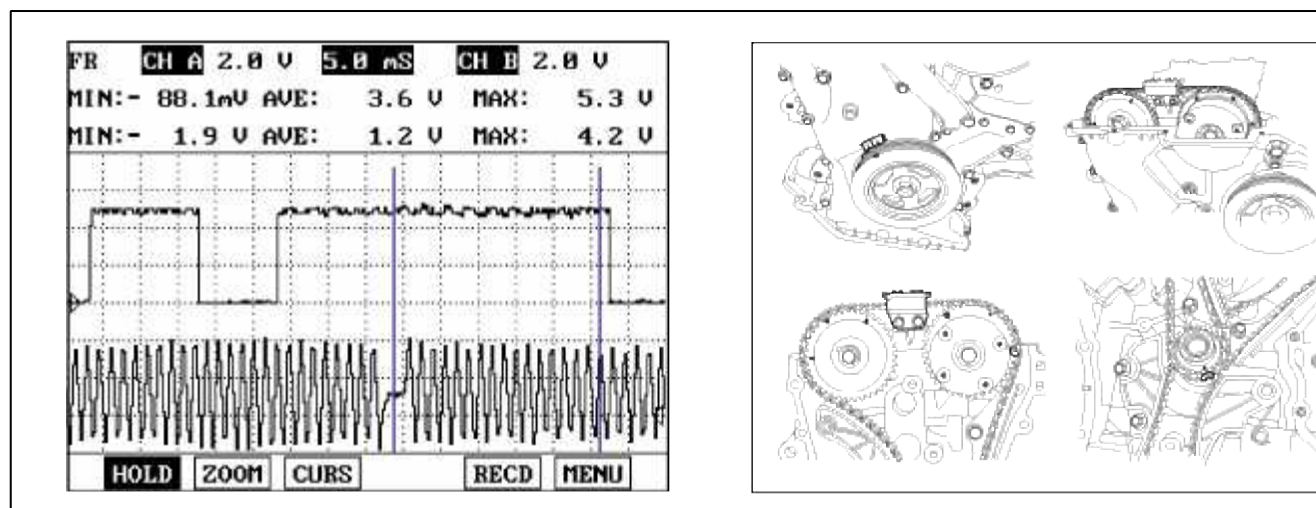
Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

#### 5. Check Timing

- (1) Ignition "OFF"
- (2) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly aligned.

Reference : The 17th of CKP signal from missing tooth is aligned with high of CMP signal



- (3) Are all timing marks aligned correctly ?

**YES**

Go to "Check Fuel Pressure" as indicated below

**NO**

Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure



## 6. Check Fuel Pressure

**NOTE**

1. Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
2. The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- (2) Start-up and wait until it stops itself.
- (3) IG "OFF" and connect Fuel Pump Relay.
- (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- (6) Measure the fuel pressure at idle.

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Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm<sup>2</sup>, 54.3 ~ 55.8 psi)

---

- (7) Is the measured fuel pressure within specifications ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

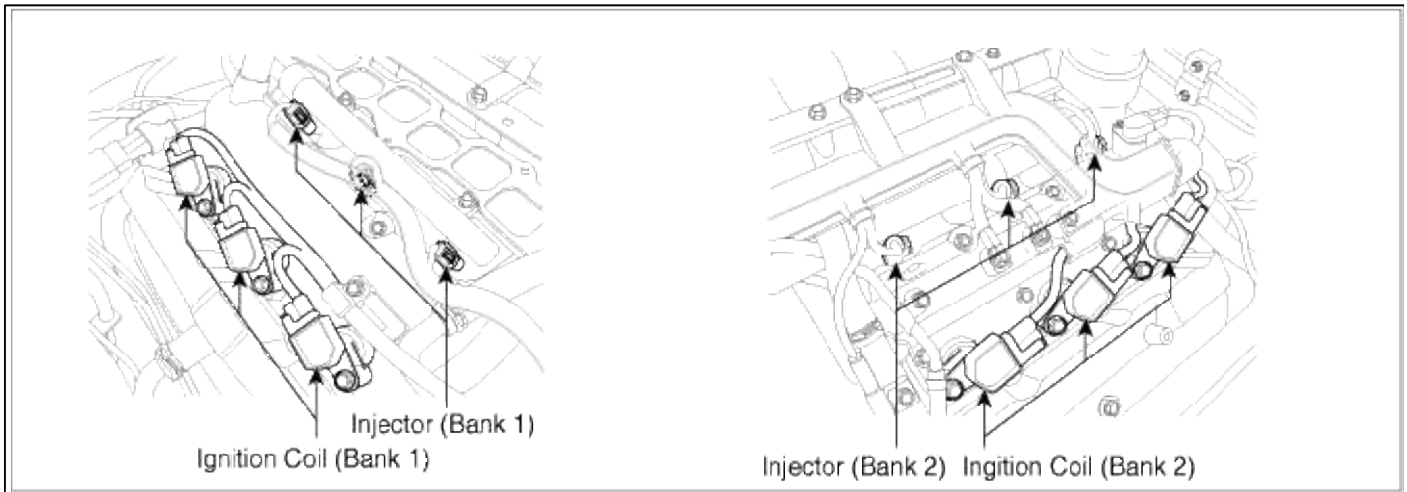
**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## COMPONENT LOCATION



## GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

## DTC DESCRIPTION

The ECM measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred. When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire causes a loss of torque produced from that cylinder, ECM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indicator Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Individual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., ECM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

## DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC strategy		<ul style="list-style-type: none"> <li>Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Spark plugs</li> <li>Faulty Spark plug cables</li> <li>Air Leakage</li> <li>Belt deflection and Air gap of CKPS</li> <li>Incorrect timing</li> <li>Faulty injector</li> <li>Improper fuel pressure</li> <li>Improper engine compression</li> <li>Faulty ECM</li> </ul>
Enable condition		No disabling faults present / No disabling Active Faults <ul style="list-style-type: none"> <li>P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295</li> <li>P0103 / P0102 / P0108 / P0107 / P0106 / P0501</li> <li>Engine speed between 550 and 5800 RPM</li> <li>System voltage between 9 and 18 volts</li> <li>The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)</li> </ul>	
Threshold Value	Case 1	<ul style="list-style-type: none"> <li>Individual cylinder misfire detection</li> </ul>	
	Case 2	<ul style="list-style-type: none"> <li>Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)</li> </ul>	
	Case 3	<ul style="list-style-type: none"> <li>Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)</li> </ul>	
Diagnosis time		<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
MIL ON condition		<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu.
- (4) Read "DTC Status" parameter.

<div>1.1 DIAGNOSTIC TROUBLE CODES</div> <div>PXXXX DTC TITLE</div> <div>NUMBER OF DTC : 1 ITEMS</div> <div> <div>PART</div> <div>ERAS</div> <div>DTAL</div> </div>	<div>PXXXX TITLE</div> <div> <div>1.MIL STATUS: ON/OFF</div> <div>2.DTC STATUS: PRESENT/HISTORY</div> <div>3.DIAG.STATUS: DIAGNOSIS FINISHED</div> </div> <div>DTC CAUSE TO SYSTEM ERROR : PXXXX</div>
--	--

(5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced w/ condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

## SYSTEM INSPECTION

### 1. Check Spark Pulg

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Air Leakage " as indicated below

### 2. Check Air Leakage

(1) Visually/physically inspect the intake/exhaust system as following items,

- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

### 3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by puling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from prot "A" and verify that air comes out of prot "B"

(6) Blow through valve from prot "B" and verify that no air comes out of port "A"

(7) Has a problem been found ?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Compression pressure" as indicated below

#### 4. Check Compression pressure

- (1) Warm up the engine to normal operating temperature
- (2) Disconnect the spark plug cables and remove the spark plugs.
- (3) Crank the engine to remove any foreign material in the cylinders.
- (4) Put compression pressure gauge into spark plug hole
- (5) Crank the engine with widely open throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm<sup>2</sup>,192 psi)

- (6) Is compression pressure for each cylinder displayed within specifications ?

**YES**

Go to "Check Timing " as indicated below

**NO**

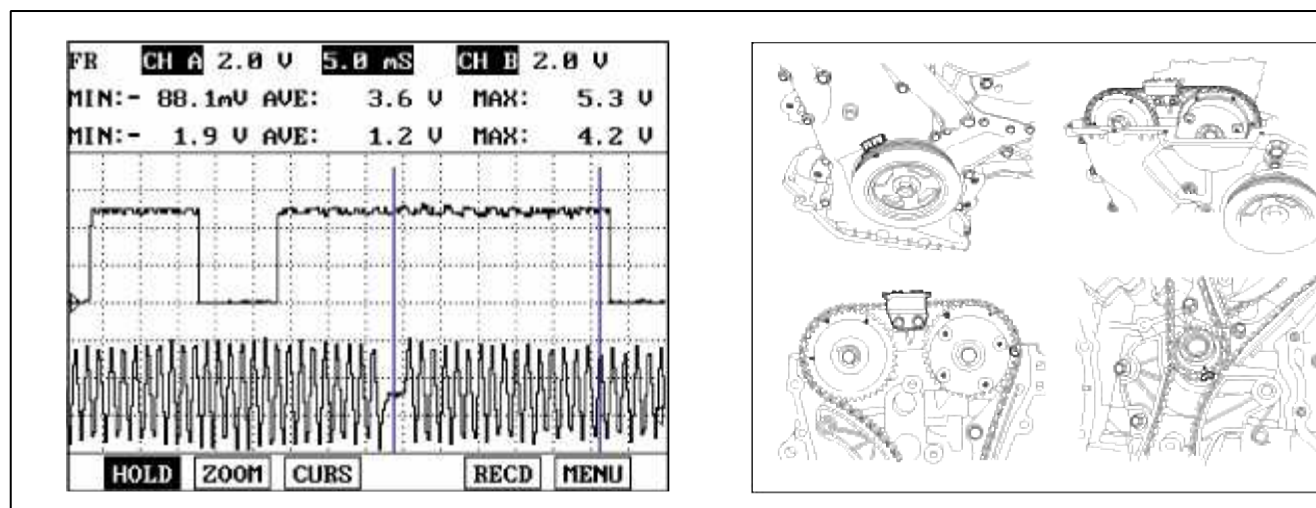
Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

#### 5. Check Timing

- (1) Ignition "OFF"
- (2) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly aligned.

Reference : The 17th of CKP signal from missing tooth is aligned with high of CMP signal



- (3) Are all timing marks aligned correctly ?

**YES**

Go to "Check Fuel Pressure" as indicated below

**NO**

Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

## 6. Check Fuel Pressure

**NOTE**

1. Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
2. The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- (2) Start-up and wait until it stops itself.
- (3) IG "OFF" and connect Fuel Pump Relay.
- (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- (6) Measure the fuel pressure at idle.

---

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm<sup>2</sup>, 54.3 ~ 55.8 psi)

---

- (7) Is the measured fuel pressure within specifications ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

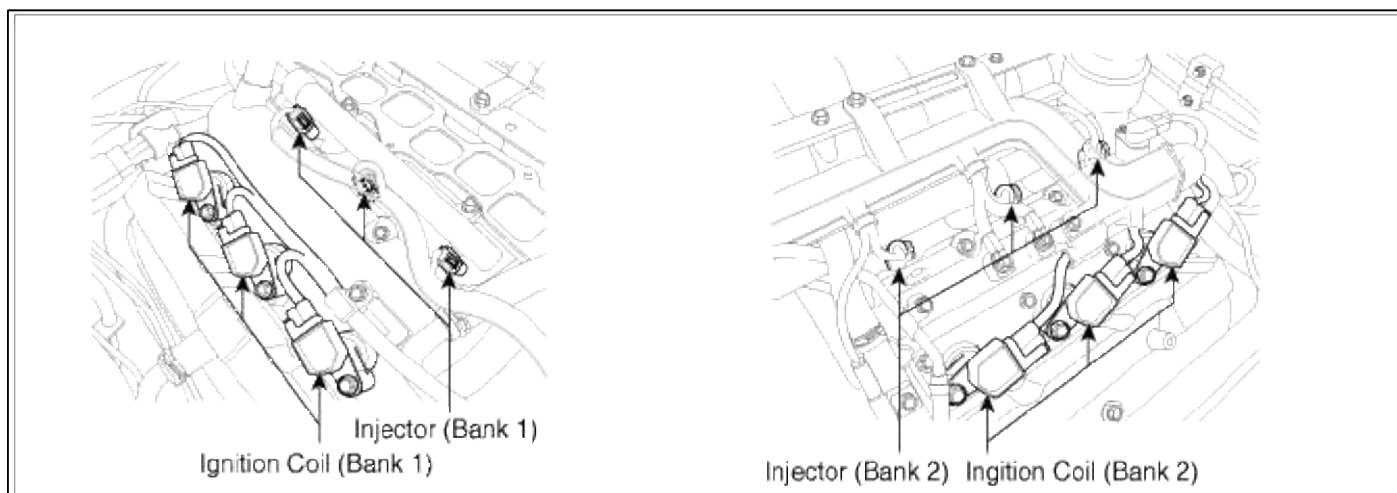
**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## COMPONENT LOCATION



## GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

## DTC DESCRIPTION

The ECM measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred. When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire causes a loss of torque produced from that cylinder, ECM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indicator Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Individual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., ECM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

## DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC strategy		<ul style="list-style-type: none"> <li>Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Spark plugs</li> <li>Faulty Spark plug cables</li> <li>Air Leakage</li> <li>Belt deflection and Air gap of CKPS</li> <li>Incorrect timing</li> <li>Faulty injector</li> <li>Improper fuel pressure</li> <li>Improper engine compression</li> <li>Faulty ECM</li> </ul>
Enable condition		No disabling faults present / No disabling Active Faults <ul style="list-style-type: none"> <li>P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295</li> <li>P0103 / P0102 / P0108 / P0107 / P0106 / P0501</li> <li>Engine speed between 550 and 5800 RPM</li> <li>System voltage between 9 and 18 volts</li> <li>The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)</li> </ul>	
Threshold Value	Case 1	<ul style="list-style-type: none"> <li>Individual cylinder misfire detection</li> </ul>	
	Case 2	<ul style="list-style-type: none"> <li>Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)</li> </ul>	
	Case 3	<ul style="list-style-type: none"> <li>Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)</li> </ul>	
Diagnosis time		<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
MIL ON condition		<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu.
- (4) Read "DTC Status" parameter.

<div>1.1 DIAGNOSTIC TROUBLE CODES</div> <div>PXXXX DTC TITLE</div> <div>NUMBER OF DTC : 1 ITEMS</div> <div> <div>PART</div> <div>ERAS</div> <div>DTAL</div> </div>	<div>PXXXX TITLE</div> <div> 1.MIL STATUS: ON/OFF  2.DTC STATUS: PRESENT/HISTORY  3.DIAG.STATUS: DIAGNOSIS FINISHED </div> <div>DTC CAUSE TO SYSTEM ERROR : PXXXX</div>
--	---



(5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced w/ condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

## SYSTEM INSPECTION

### 1. Check Spark Plug

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Air Leakage " as indicated below

### 2. Check Air Leakage

(1) Visually/physically inspect the intake/exhaust system as following items,

- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

### 3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by pulling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from port "A" and verify that air comes out of port "B"

(6) Blow through valve from port "B" and verify that no air comes out of port "A"

(7) Has a problem been found ?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Compression pressure" as indicated below

#### 4. Check Compression pressure

- (1) Warm up the engine to normal operating temperature
- (2) Disconnect the spark plug cables and remove the spark plugs.
- (3) Crank the engine to remove any foreign material in the cylinders.
- (4) Put compression pressure gauge into spark plug hole
- (5) Crank the engine with widely opened throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm<sup>2</sup>,192 psi)

- (6) Is compression pressure for each cylinder displayed within specifications ?

**YES**

Go to "Check Timing " as indicated below

**NO**

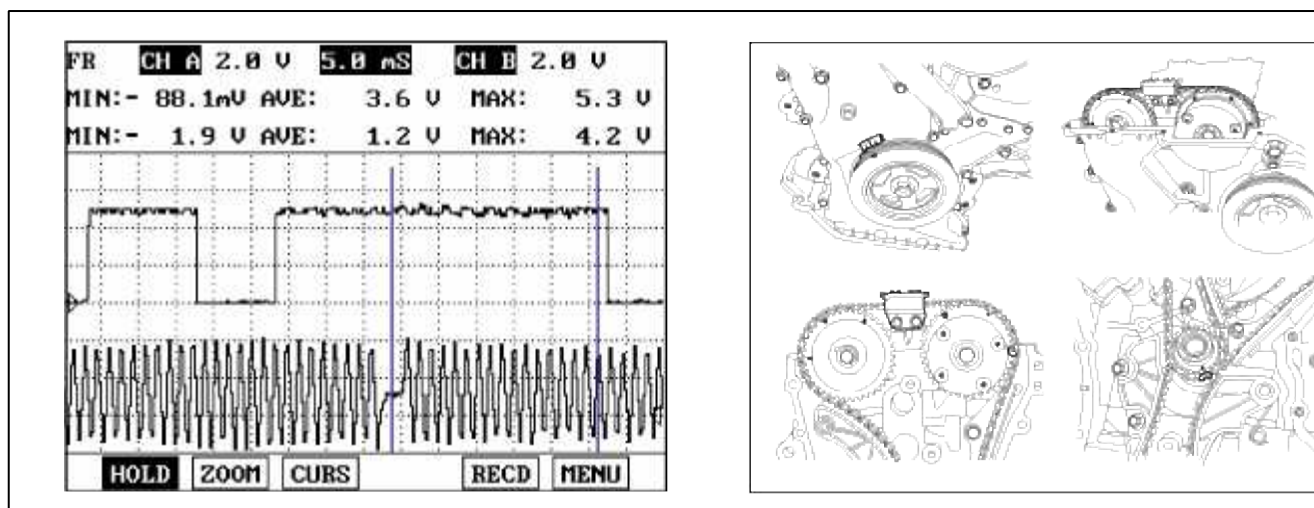
Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

#### 5. Check Timing

- (1) Ignition "OFF"
- (2) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly aligned.

Reference : The 17th of CKP signal from missing tooth is aligned with high of CMP signal



- (3) Are all timing marks aligned correctly ?

**YES**

Go to "Check Fuel Pressure" as indicated below

**NO**

Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

## 6. Check Fuel Pressure

**NOTE**

1. Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
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- (3) IG "OFF" and connect Fuel Pump Relay.
- (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- (6) Measure the fuel pressure at idle.

---

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm<sup>2</sup>, 54.3 ~ 55.8 psi)

---

- (7) Is the measured fuel pressure within specifications ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

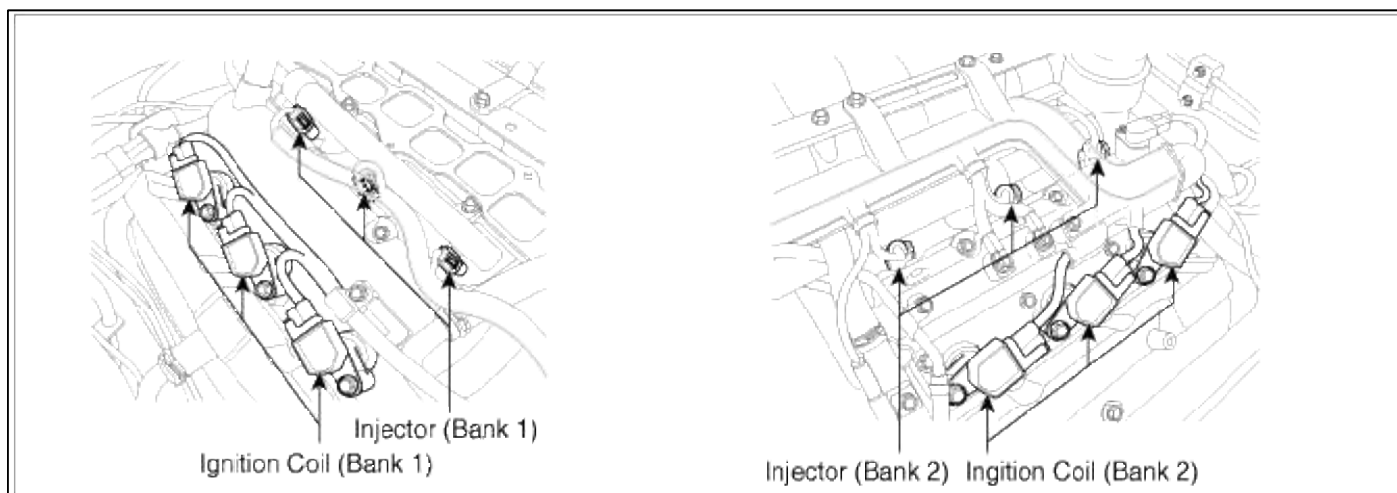
**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## COMPONENT LOCATION



## GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

## DTC DESCRIPTION

The ECM measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred. When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. ECM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indicator Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Individual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., ECM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

## DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC strategy		<ul style="list-style-type: none"> <li>Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Spark plugs</li> <li>Faulty Spark plug cables</li> <li>Air Leakage</li> <li>Belt deflection and Air gap of CKPS</li> <li>Incorrect timing</li> <li>Faulty injector</li> <li>Improper fuel pressure</li> <li>Improper engine compression</li> <li>Faulty ECM</li> </ul>
Enable condition		No disabling faults present / No disabling Active Faults <ul style="list-style-type: none"> <li>P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295</li> <li>P0103 / P0102 / P0108 / P0107 / P0106 / P0501</li> <li>Engine speed between 550 and 5800 RPM</li> <li>System voltage between 9 and 18 volts</li> <li>The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)</li> </ul>	
Threshold Value	Case 1	<ul style="list-style-type: none"> <li>Individual cylinder misfire detection</li> </ul>	
	Case 2	<ul style="list-style-type: none"> <li>Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)</li> </ul>	
	Case 3	<ul style="list-style-type: none"> <li>Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)</li> </ul>	
Diagnosis time		<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
MIL ON condition		<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu.
- (4) Read "DTC Status" parameter.

<div>1.1 DIAGNOSTIC TROUBLE CODES</div> <div>PXXXX DTC TITLE</div> <div>NUMBER OF DTC : 1 ITEMS</div> <div> <div>PART</div> <div>ERAS</div> <div>DTAL</div> </div>	<div>PXXXX TITLE</div> <div> 1.MIL STATUS: ON/OFF  2.DTC STATUS: PRESENT/HISTORY  3.DIAG.STATUS: DIAGNOSIS FINISHED </div> <div>DTC CAUSE TO SYSTEM ERROR : PXXXX</div>
--	---

(5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced w/ condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

## SYSTEM INSPECTION

### 1. Check Spark Pulg

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Air Leakage " as indicated below

### 2. Check Air Leakage

(1) Visually/physically inspect the intake/exhaust system as following items,

- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

### 3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by puling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from prot "A" and verify that air comes out of prot "B"

(6) Blow through valve from prot "B" and verify that no air comes out of port "A"

(7) Has a problem been found ?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Compression pressure" as indicated below

#### 4. Check Compression pressure

- (1) Warm up the engine to normal operating temperature
- (2) Disconnect the spark plug cables and remove the spark plugs.
- (3) Crank the engine to remove any foreign material in the cylinders.
- (4) Put compression pressure gauge into spark plug hole
- (5) Crank the engine with widely open throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm<sup>2</sup>,192 psi)

- (6) Is compression pressure for each cylinder displayed within specifications ?

**YES**

Go to "Check Timing " as indicated below

**NO**

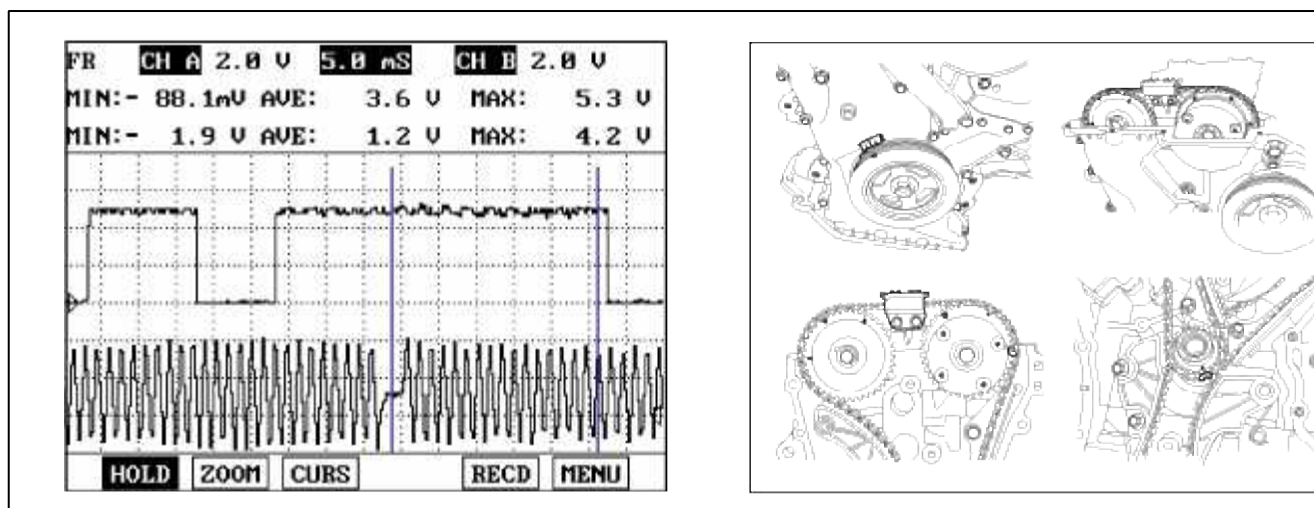
Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

#### 5. Check Timing

- (1) Ignition "OFF"
- (2) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly aligned.

Reference : The 17th of CKP signal from missing tooth is aligned with high of CMP signal



- (3) Are all timing marks aligned correctly ?

**YES**

Go to "Check Fuel Pressure" as indicated below

**NO**

Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

## 6. Check Fuel Pressure

**NOTE**

1. Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
2. The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- (2) Start-up and wait until it stops itself.
- (3) IG "OFF" and connect Fuel Pump Relay.
- (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- (6) Measure the fuel pressure at idle.

---

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm<sup>2</sup>, 54.3 ~ 55.8 psi)

---

- (7) Is the measured fuel pressure within specifications ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

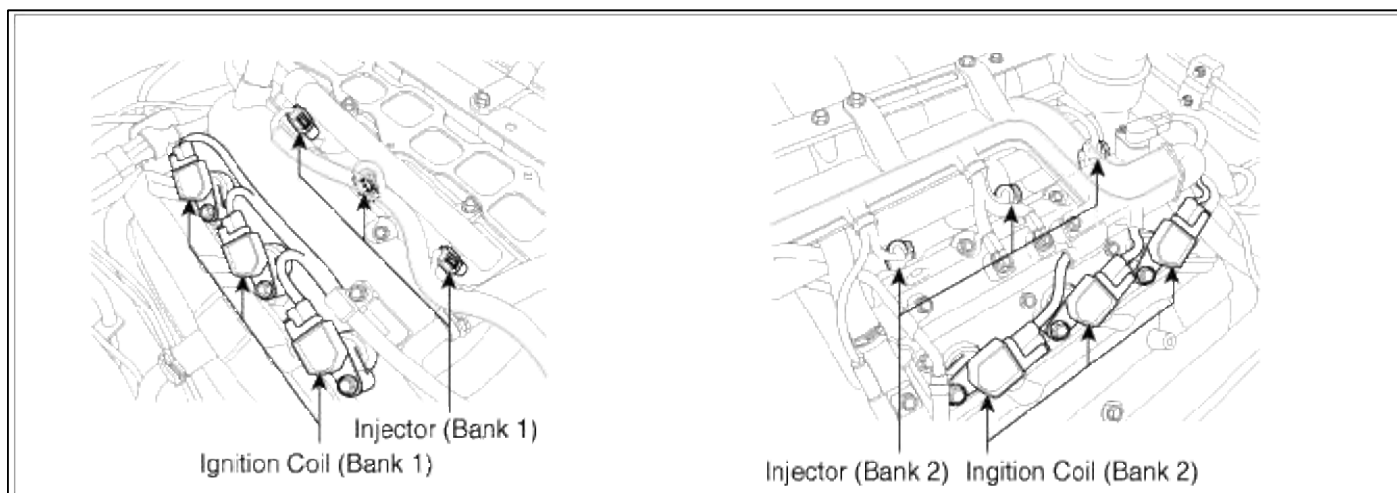
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.



## COMPONENT LOCATION



## GENERAL DESCRIPTION

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

## DTC DESCRIPTION

The ECM measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred. When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire cause a loss of torque produced from that cylinder. ECM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indicator Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Individual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., ECM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

## DTC DETECTING CONDITION

Item		Detecting Condition	Possible Cause
DTC strategy		<ul style="list-style-type: none"> <li>Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Spark plugs</li> <li>Faulty Spark plug cables</li> <li>Air Leakage</li> <li>Belt deflection and Air gap of CKPS</li> <li>Incorrect timing</li> <li>Faulty injector</li> <li>Improper fuel pressure</li> <li>Improper engine compression</li> <li>Faulty ECM</li> </ul>
Enable condition		No disabling faults present / No disabling Active Faults <ul style="list-style-type: none"> <li>P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295</li> <li>P0103 / P0102 / P0108 / P0107 / P0106 / P0501</li> <li>Engine speed between 550 and 5800 RPM</li> <li>System voltage between 9 and 18 volts</li> <li>The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)</li> </ul>	
Threshold Value	Case 1	<ul style="list-style-type: none"> <li>Individual cylinder misfire detection</li> </ul>	
	Case 2	<ul style="list-style-type: none"> <li>Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)</li> </ul>	
	Case 3	<ul style="list-style-type: none"> <li>Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)</li> </ul>	
Diagnosis time		<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
MIL ON condition		<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu.
- (4) Read "DTC Status" parameter.

<div>1.1 DIAGNOSTIC TROUBLE CODES</div> <div>PXXXX DTC TITLE</div> <div>NUMBER OF DTC : 1 ITEMS</div> <div> <div>PART</div> <div>ERAS</div> <div>DTAL</div> </div>	<div>PXXXX TITLE</div> <div> <div>1.MIL STATUS: ON/OFF</div> <div>2.DTC STATUS: PRESENT/HISTORY</div> <div>3.DIAG.STATUS: DIAGNOSIS FINISHED</div> </div> <div>DTC CAUSE TO SYSTEM ERROR : PXXXX</div>
--	--

(5) Is "Present" Fault displayed?

**YES**

Go to "System Inspection" procedure.

**NO**

Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced w/ condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

## SYSTEM INSPECTION

### 1. Check Spark Plug

(1) Remove cylinder's spark plugs

(2) Visually/physically inspect the following items:

- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(3) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Air Leakage " as indicated below

### 2. Check Air Leakage

(1) Visually/physically inspect the intake/exhaust system as following items,

- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage

(2) Has a problem been found in any of the above areas?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

### 3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

(1) Remove PCV valve from cylinder head cover by pulling ventilation hose

(2) With engine idling block PCV valve opening

(3) Verify that vacuum is felt

(4) Remove PCV valve

(5) Blow through valve from port "A" and verify that air comes out of port "B"

(6) Blow through valve from port "B" and verify that no air comes out of port "A"

(7) Has a problem been found ?

**YES**

Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Check Compression pressure" as indicated below

#### 4. Check Compression pressure

- (1) Warm up the engine to normal operating temperature
- (2) Disconnect the spark plug cables and remove the spark plugs.
- (3) Crank the engine to remove any foreign material in the cylinders.
- (4) Put compression pressure gauge into spark plug hole
- (5) Crank the engine with widely open throttle valve and check compression pressure at each cylinder

Specification : 1323kPa(13.5 kg/cm<sup>2</sup>,192 psi)

- (6) Is compression pressure for each cylinder displayed within specifications ?

**YES**

Go to "Check Timing " as indicated below

**NO**

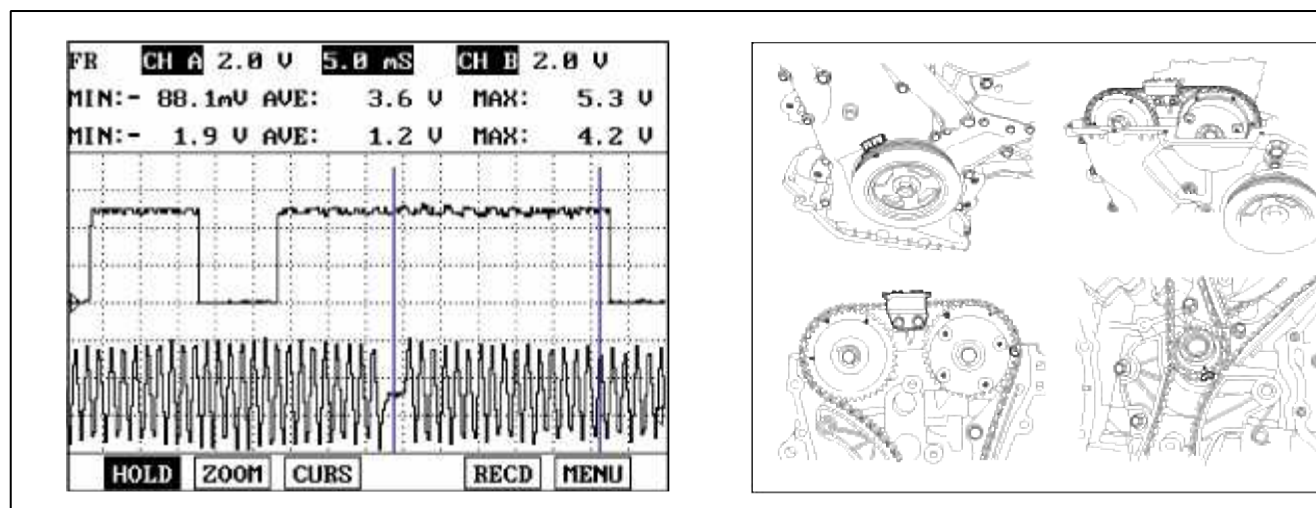
Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

#### 5. Check Timing

- (1) Ignition "OFF"
- (2) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly aligned.

Reference : The 17th of CKP signal from missing tooth is aligned with high of CMP signal



- (3) Are all timing marks aligned correctly ?

**YES**

Go to "Check Fuel Pressure" as indicated below

**NO**

Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

## 6. Check Fuel Pressure

**NOTE**

1. Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
2. The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- (1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- (2) Start-up and wait until it stops itself.
- (3) IG "OFF" and connect Fuel Pump Relay.
- (4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- (5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- (6) Measure the fuel pressure at idle.

---

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm<sup>2</sup>, 54.3 ~ 55.8 psi)

---

- (7) Is the measured fuel pressure within specifications ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel Pressure is too low	Fuel filter, fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel Pressure is too high	Fuel pressure regulator, hose or pipe

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

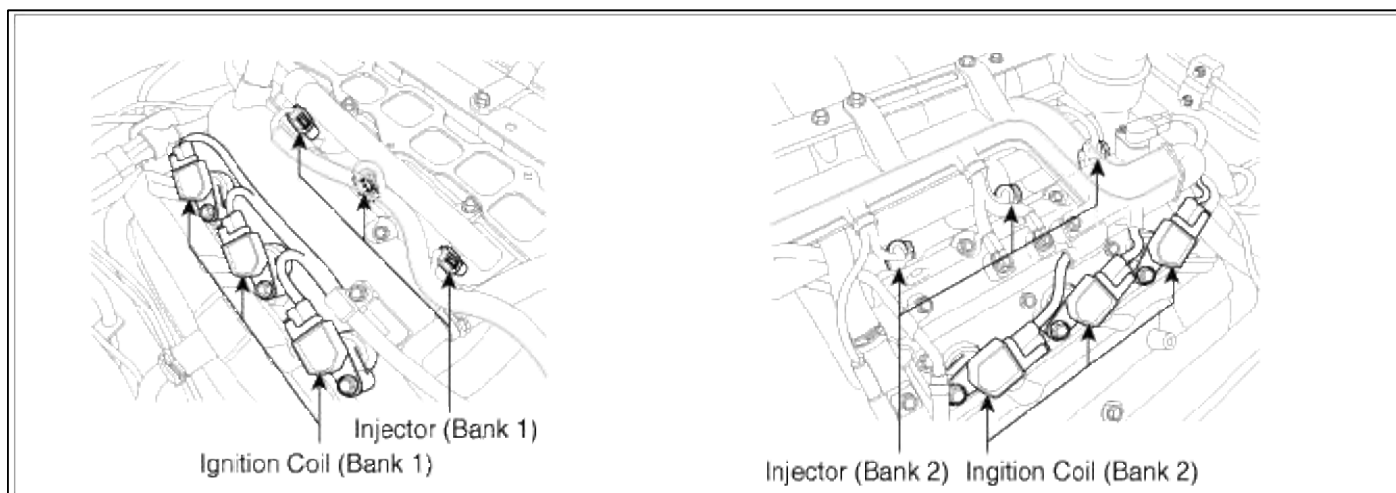
**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## COMPONENT LOCATION



## GENERAL DESCRIPTION

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for primary coil circuit control. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

## DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if the signals indicating open or short in the circuit are detected for more than 5 sec., ECM sets this DTC. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Detects a short to ground, to battery or open circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open or short in harness</li> <li>• Ignition Coil</li> <li>• ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• NO DTC related to this item</li> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> <li>• The above conditions are met <math>&gt; 0.5</math> sec.</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Open or short</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>• Continuous (More than 5 sec.failure for every 10 sec.test)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

- (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSEPCTION

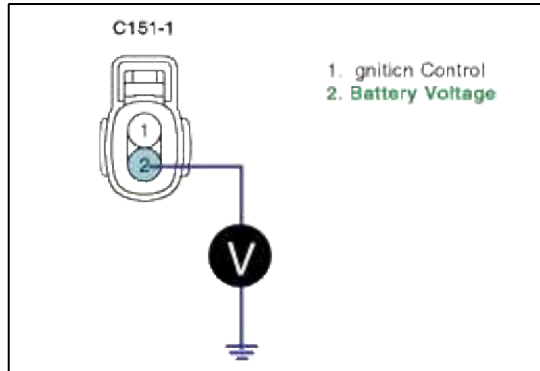
## 1. Check voltage

- (1) IG "OFF" and disconnect Ignition Coil connector.
- (2) IG "ON" and ENG "OFF"
- (3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

---

Specification : Approx. B+

---



- (4) Is the measured voltage within specification ?

**YES**

Go to "Control Circuit Inspection" procedure.

**NO**

Check fuse connected to ignition coil for open.

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

## CONTROL CIRCUIT INSPECTION

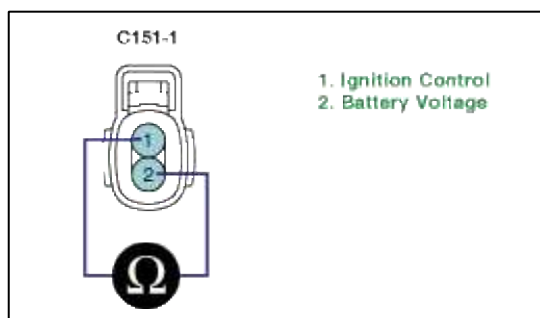
## 1. Check short to battery in harness.

- (1) IG "OFF" and disconnect ignitioncoil connector and ECM connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

---

Specification : Infinite

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Check short to ground in harness" as follows.

**NO**

Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.



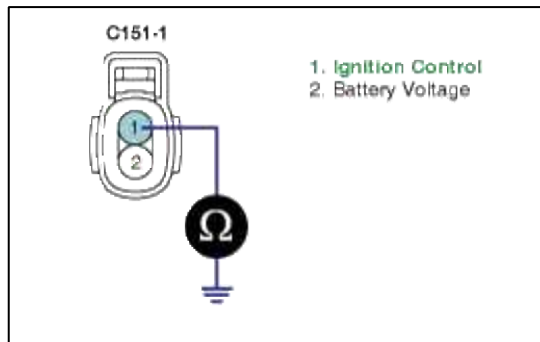
## 2. Check short to ground in harness

- (1) IG "OFF" and disconnect ignition coil connector and ECM connector.
- (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

---

Specification : Infinite

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Check open in harness" as follows.

**NO**

Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

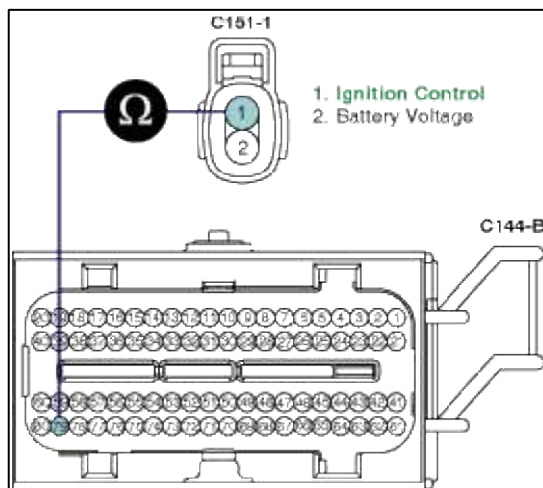
## 3. Check open in harness

- (1) IG "OFF" and disconnect Ignition Coil connector and ECM connector.
- (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 79 of ECM harness connector(C144-B).

---

Specification : Below 1Ω

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

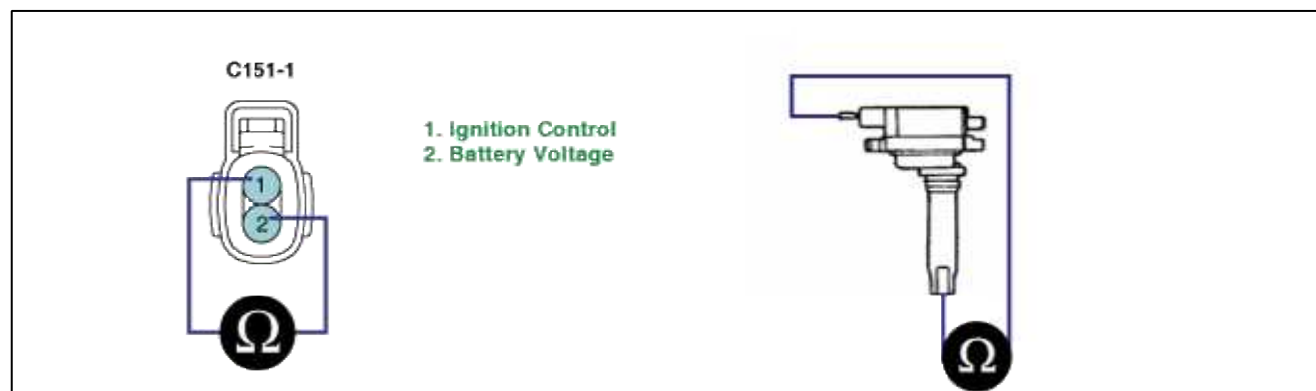
## COMPONENT INSPECTION

## 1. Check Ignition Coil

- (1) IG "OFF" and disconnect ignition coil connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
- (3) Measure resistance between terminal 2 of ignition coil connector and out terminal of secondary ignition coil.

**Specification :**

Resistance ( $\Omega$ )	Primary Coil (A)	Secondary Coil (B)
	$0.62 \pm 10\% (\Omega)$	$7.0 \pm 15\% (k\Omega)$



- (4) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good Ignition Coil and check for proper operation.

If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

**VERIFICATION OF VEHICLE REPAIR**

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

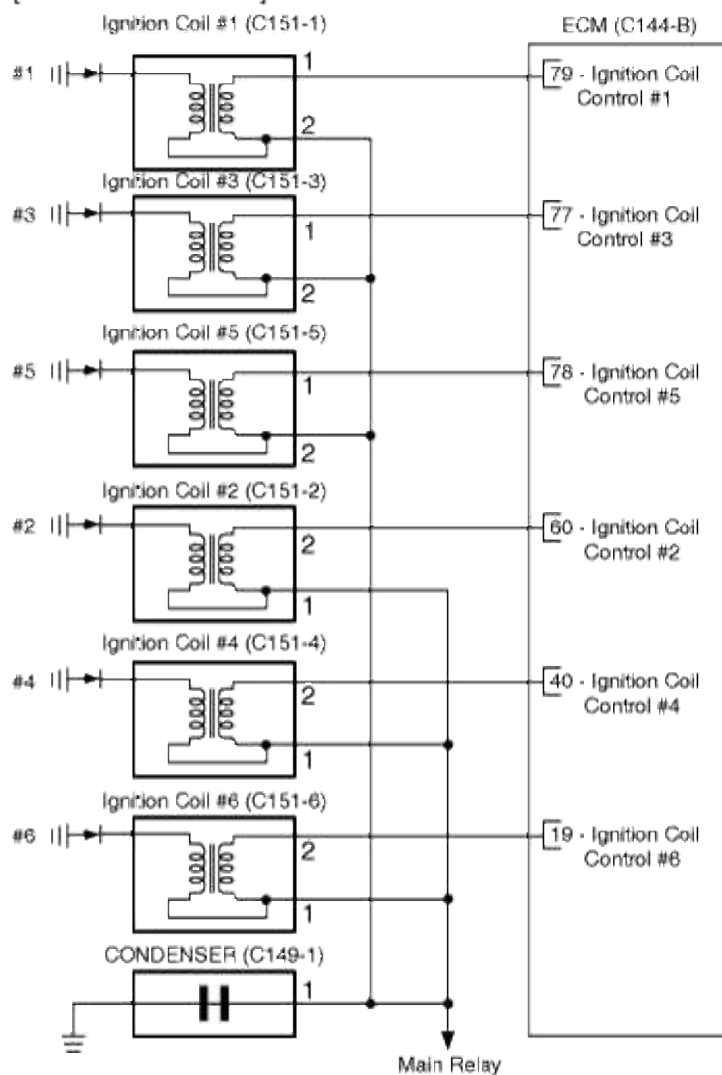
System performing to specification at this time. Clear the DTC

**NO**

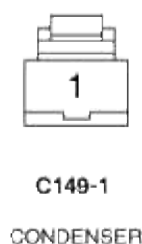
Go to the applicable troubleshooting procedure.

**SCHEMATIC DIAGRAM**

## [CIRCUIT DIAGRAM]



## [HARNESS CONNECTOR]



## [CONNECTOR INFORMATION]

## Ignition Coil #1

Terminal	Connected to	Function
1	ECM C144-B (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

## Ignition Coil #3

Terminal	Connected to	Function
1	ECM C144-B (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

## Ignition Coil #5

Terminal	Connected to	Function
1	ECM C144-B (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

## Ignition Coil #2

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (60)	Ignition Coil #2

## Ignition Coil #4

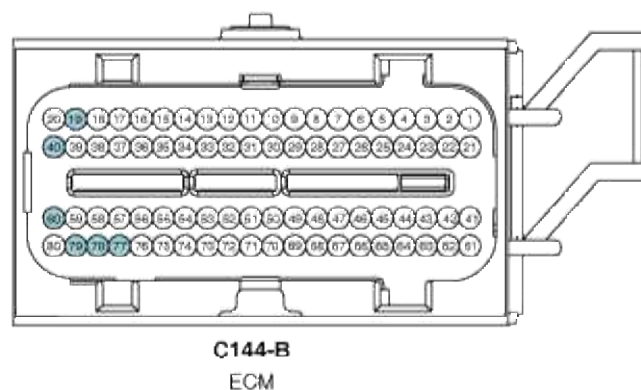
Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (40)	Ignition Coil #4

## Ignition Coil #6

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (19)	Ignition Coil #6

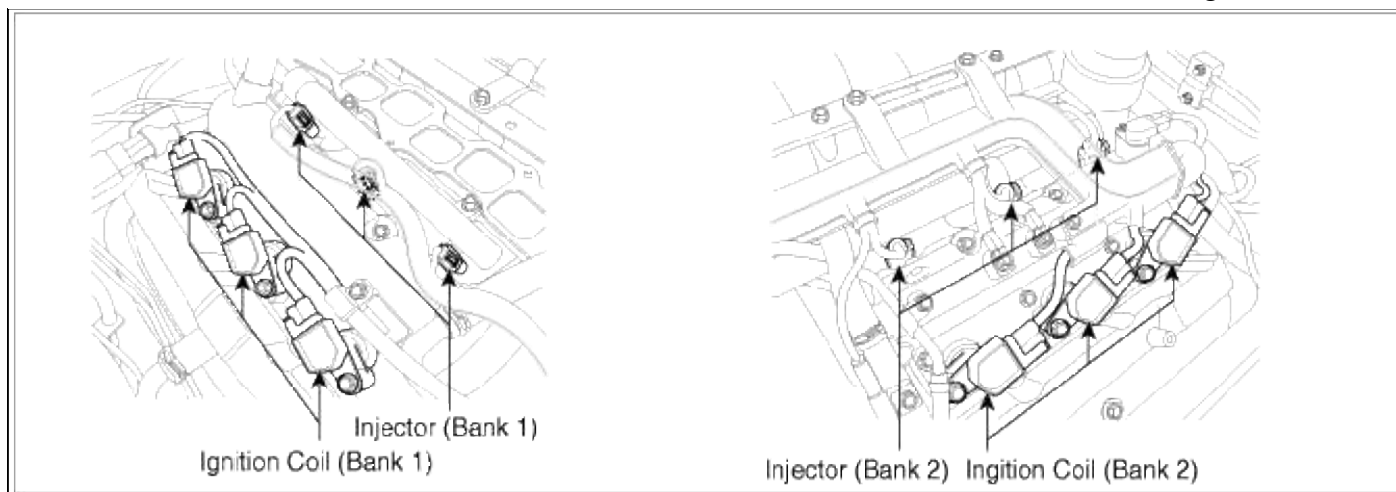
## CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)



## Engine Electrical System &gt; Troubleshooting &gt; P0352

## COMPONENT LOCATION



## GENERAL DESCRIPTION

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for primary coil circuit control. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

## DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if the signals indicating open or short in the circuit are detected for more than 5 sec., ECM sets this DTC. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Detects a short to ground, to battery or open circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open or short in harness</li> <li>• Ignition Coil</li> <li>• ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• NO DTC related to this item</li> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> <li>• The above conditions are met <math>&gt; 0.5</math> sec.</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Open or short</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>• Continuous (More than 5 sec.failure for every 10 sec.test)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

- (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSEPCTION

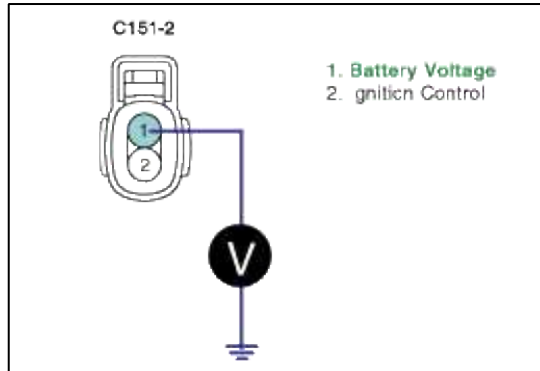
## 1. Check voltage

- (1) IG "OFF" and disconnect Ignition Coil connector.
- (2) IG "ON" and ENG "OFF"
- (3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

---

Specification : Approx. B+

---



- (4) Is the measured voltage within specification ?

**YES**

Go to "Control Circuit Inspection" procedure.

**NO**

Check fuse connected to ignition coil for open.

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

## CONTROL CIRCUIT INSPECTION

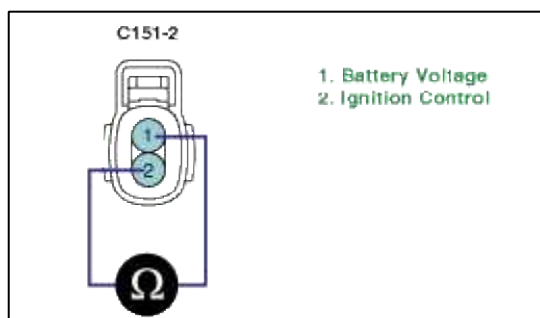
## 1. Check short to battery in harness.

- (1) IG "OFF" and disconnect ignitioncoil connector and ECM connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

---

Specification : Infinite

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Check short to ground in harness" as follows.

**NO**

Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

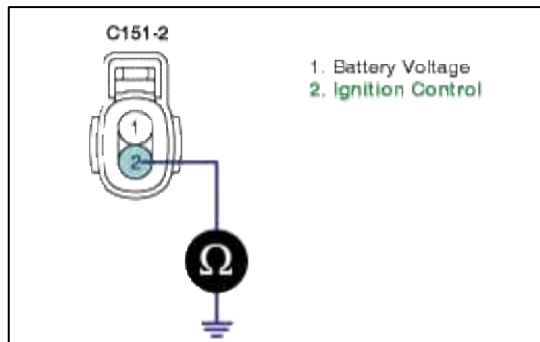
## 2. Check short to ground in harness

- (1) IG "OFF" and disconnect ignition coil connector and ECM connector.
- (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

---

Specification : Infinite

---



## (3) Is the measured resistance within specification?

**YES**

Go to "Check open in harness" as follows.

**NO**

Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

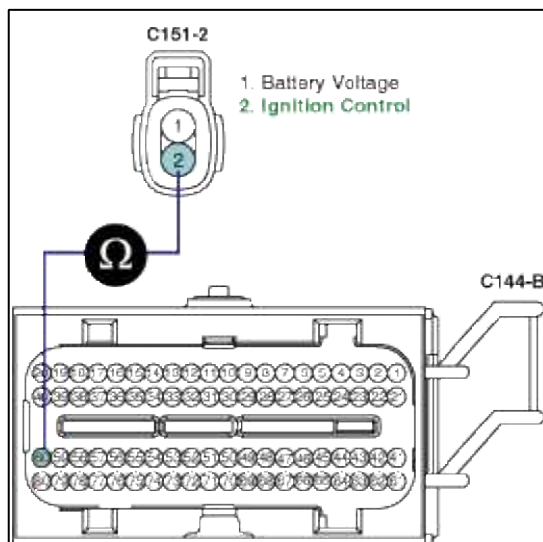
## 3. Check open in harness

- (1) IG "OFF" and disconnect Ignition Coil connector and ECM connector.
- (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 60 of ECM harness connector(C144-B).

---

Specification : Below 1Ω

---



## (3) Is the measured resistance within specification?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

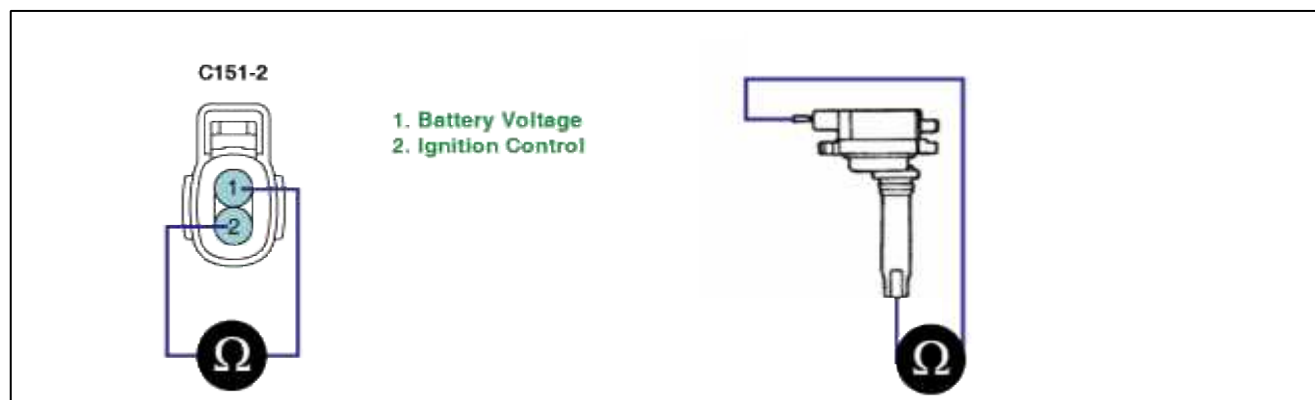
## COMPONENT INSPECTION

## 1. Check Ignition Coil

- (1) IG "OFF" and disconnect ignition coil connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
- (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

**Specification :**

Resistance ( $\Omega$ )	Primary Coil (A)	Secondary Coil (B)
	$0.62 \pm 10\% (\Omega)$	$7.0 \pm 15\% (k\Omega)$



- (4) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good Ignition Coil and check for proper operation.

If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

**VERIFICATION OF VEHICLE REPAIR**

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

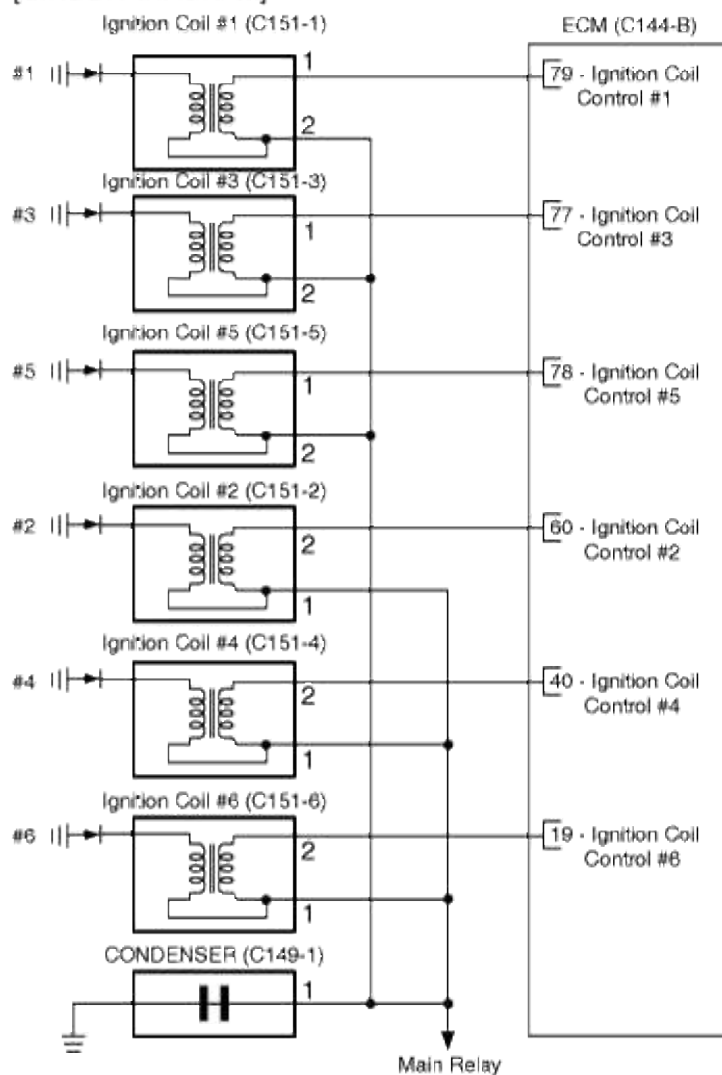
**NO**

Go to the applicable troubleshooting procedure.

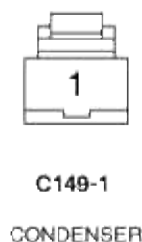
**SCHEMATIC DIAGRAM**



## [CIRCUIT DIAGRAM]



## [HARNESS CONNECTOR]



## [CONNECTOR INFORMATION]

## Ignition Coil #1

Terminal	Connected to	Function
1	ECM C144-B (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

## Ignition Coil #3

Terminal	Connected to	Function
1	ECM C144-B (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

## Ignition Coil #5

Terminal	Connected to	Function
1	ECM C144-B (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

## Ignition Coil #2

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (60)	Ignition Coil #2

## Ignition Coil #4

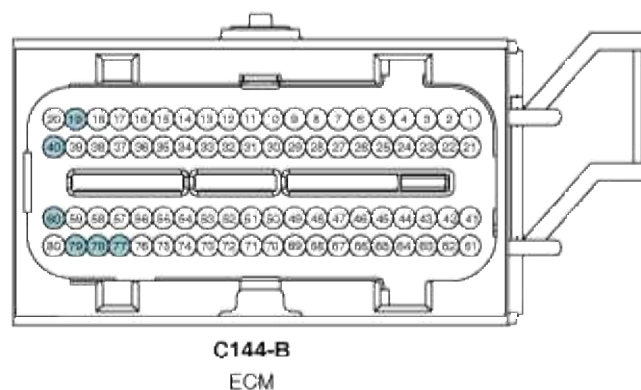
Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (40)	Ignition Coil #4

## Ignition Coil #6

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (19)	Ignition Coil #6

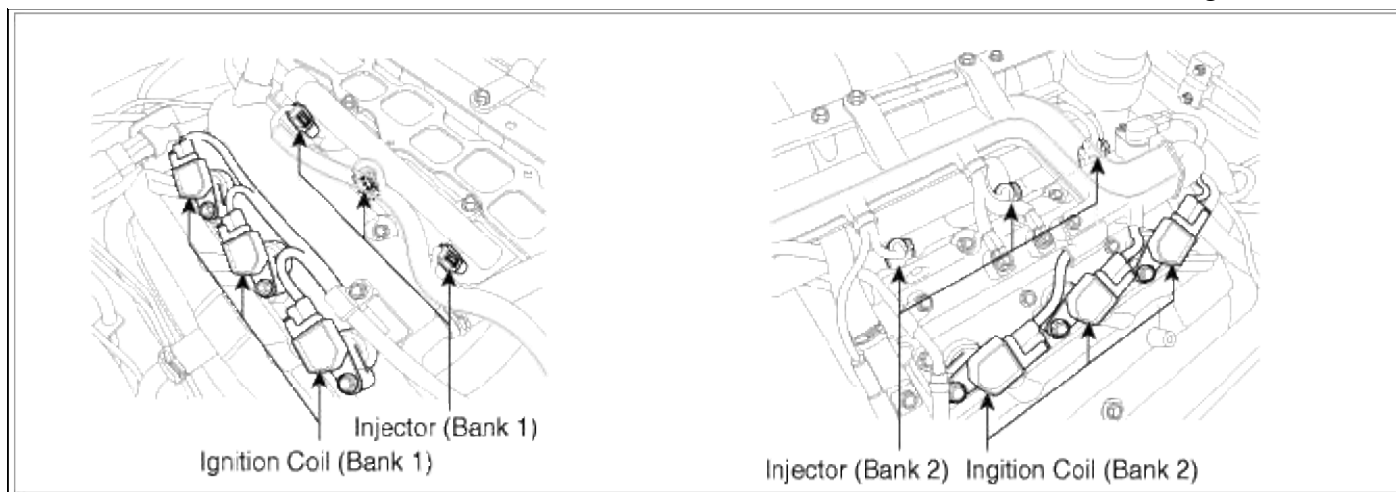
## CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)



## Engine Electrical System &gt; Troubleshooting &gt; P0353

## COMPONENT LOCATION



## GENERAL DESCRIPTION

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for primary coil circuit control. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

## DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if the signals indicating open or short in the circuit are detected for more than 5 sec., ECM sets this DTC. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Detects a short to ground, to battery or open circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open or short in harness</li> <li>• Ignition Coil</li> <li>• ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• NO DTC related to this item</li> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> <li>• The above conditions are met <math>&gt; 0.5</math> sec.</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Open or short</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>• Continuous (More than 5 sec.failure for every 10 sec.test)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

## (5) Is "Present" Fault displayed?

☐ **YES**

Go to "Terminal and connector inspection" procedure.

☐ **NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

☐ **YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

☐ **NO**

Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSEPTION

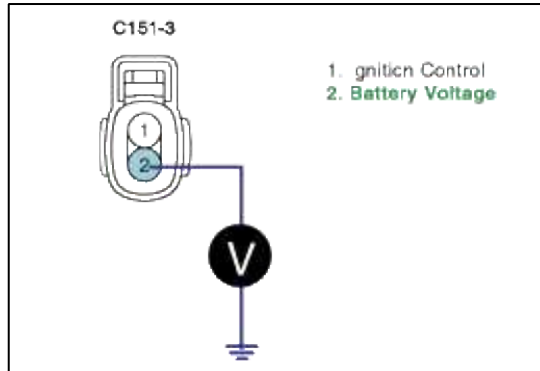
## 1. Check voltage

- (1) IG "OFF" and disconnect Ignition Coil connector.
- (2) IG "ON" and ENG "OFF"
- (3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

---

Specification : Approx. B+

---



- (4) Is the measured voltage within specification ?

**YES**

Go to "Control Circuit Inspection" procedure.

**NO**

Check fuse connected to ignition coil for open.

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

## CONTROL CIRCUIT INSPECTION

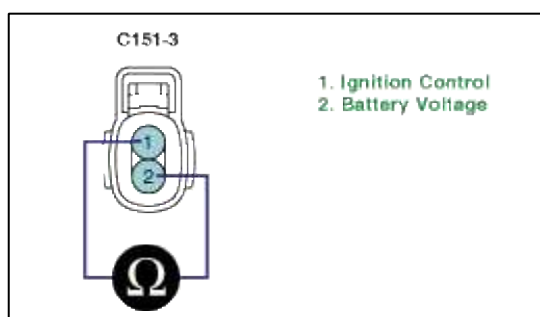
## 1. Check short to battery in harness.

- (1) IG "OFF" and disconnect ignitioncoil connector and ECM connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

---

Specification : Infinite

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Check short to ground in harness" as follows.

**NO**

Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

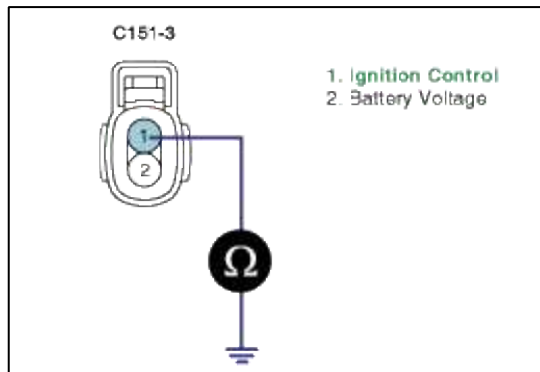
## 2. Check short to ground in harness

- (1) IG "OFF" and disconnect ignition coil connector and ECM connector.
- (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

---

Specification : Infinite

---



## (3) Is the measured resistance within specification?

**YES**

Go to "Check open in harness" as follows.

**NO**

Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

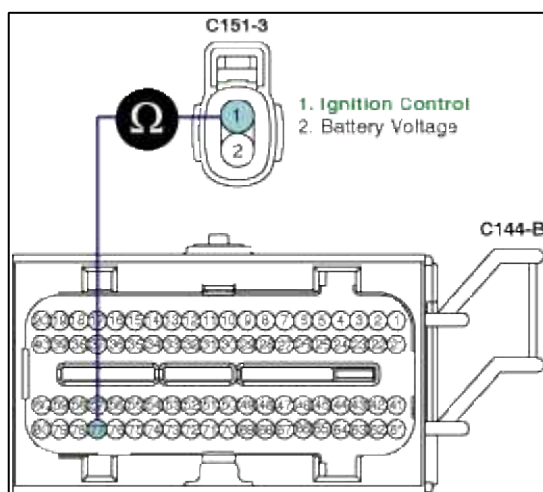
## 3. Check open in harness

- (1) IG "OFF" and disconnect Ignition Coil connector and ECM connector.
- (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 77 of ECM harness connector(C144-B).

---

Specification : Below 1Ω

---



## (3) Is the measured resistance within specification?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

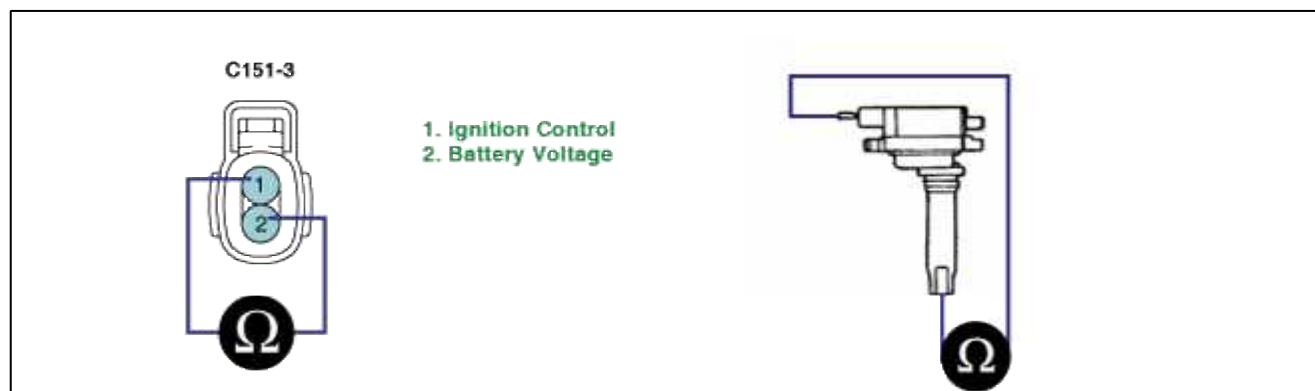
## COMPONENT INSPECTION

## 1. Check Ignition Coil

- (1) IG "OFF" and disconnect ignition coil connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
- (3) Measure resistance between terminal 2 of ignition coil connector and out terminal of secondary ignition coil.

**Specification :**

Resistance ( $\Omega$ )	Primary Coil (A)	Secondary Coil (B)
	$0.62 \pm 10\% (\Omega)$	$7.0 \pm 15\% (k\Omega)$



- (4) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good Ignition Coil and check for proper operation.

If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

**VERIFICATION OF VEHICLE REPAIR**

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

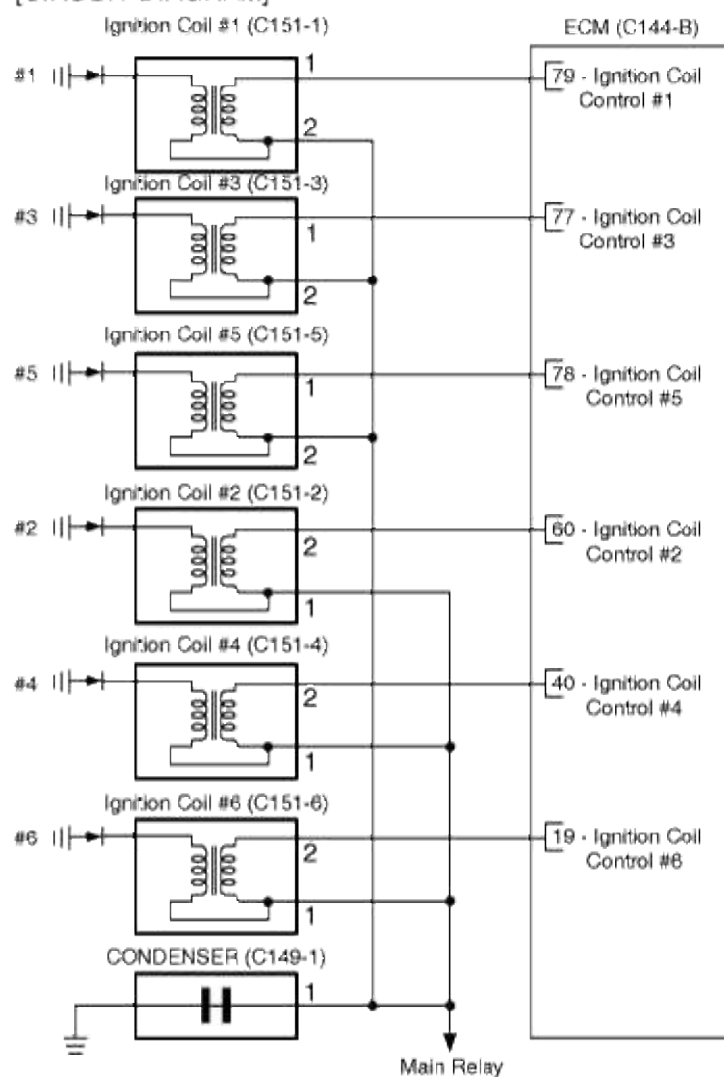
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

**SCHEMATIC DIAGRAM**

## [CIRCUIT DIAGRAM]



## [CONNECTOR INFORMATION]

## Ignition Coil #1

Terminal	Connected to	Function
1	ECM C144-B (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

## Ignition Coil #3

Terminal	Connected to	Function
1	ECM C144-B (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

## Ignition Coil #5

Terminal	Connected to	Function
1	ECM C144-B (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

## Ignition Coil #2

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (60)	Ignition Coil #2

## Ignition Coil #4

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (40)	Ignition Coil #4

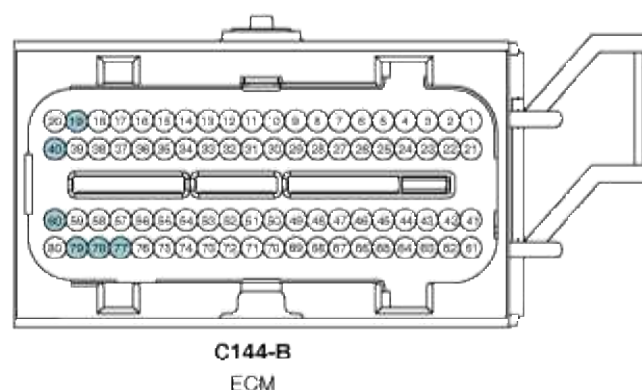
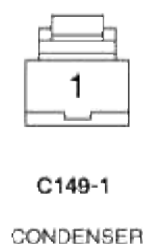
## Ignition Coil #6

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (19)	Ignition Coil #6

## CONDENSER

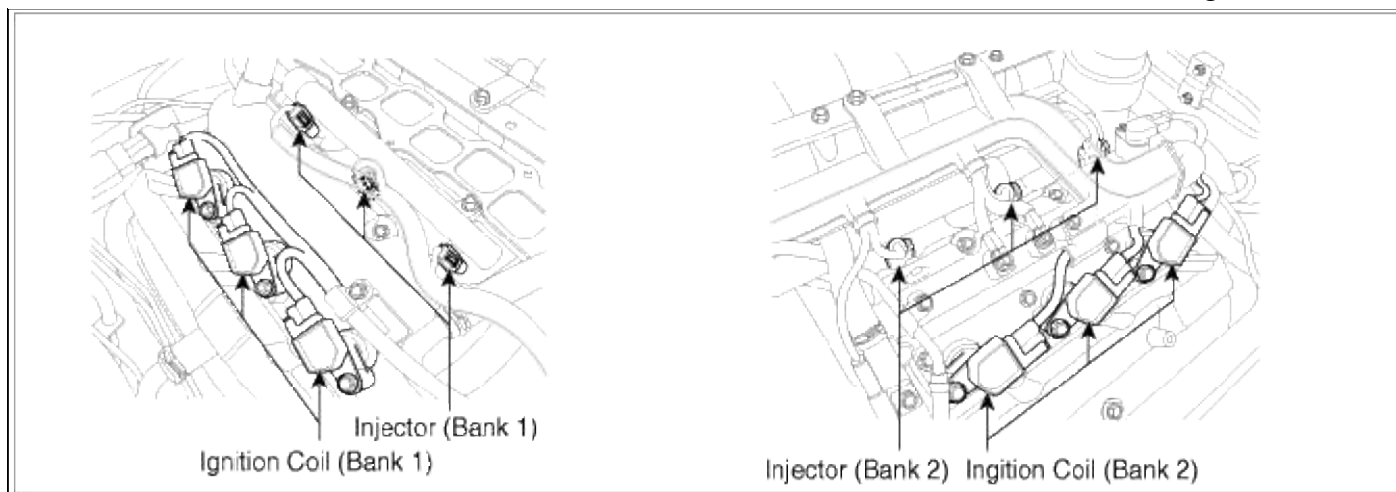
Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

## [HARNESS CONNECTOR]



## Engine Electrical System &gt; Troubleshooting &gt; P0354

## COMPONENT LOCATION



## GENERAL DESCRIPTION

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for primary coil circuit control. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

## DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if the signals indicating open or short in the circuit are detected for more than 5 sec., ECM sets this DTC. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Detects a short to ground, to battery or open circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open or short in harness</li> <li>• Ignition Coil</li> <li>• ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• NO DTC related to this item</li> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> <li>• The above conditions are met <math>&gt; 0.5</math> sec.</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Open or short</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>• Continuous (More than 5 sec.failure for every 10 sec.test)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 2 driving cycles</li> </ul>	

## MONITOR DTC STATUS



## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

## (5) Is "Present" Fault displayed?

☐ **YES**

Go to "Terminal and connector inspection" procedure.

☐ **NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

☐ **YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

☐ **NO**

Go to " Power Circuit Inspection " procedure.

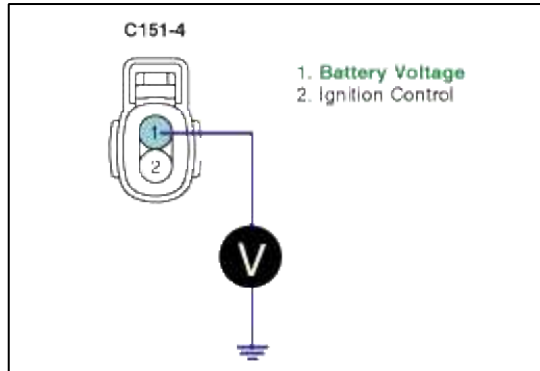
## POWER CIRCUIT INSEPTION

1. Check voltage
  - (1) IG "OFF" and disconnect Ignition Coil connector.
  - (2) IG "ON" and ENG "OFF"
  - (3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

---

Specification : Approx. B+

---



- (4) Is the measured voltage within specification ?

**YES**

Go to "Control Circuit Inspection" procedure.

**NO**

Check fuse connected to ignition coil for open.

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

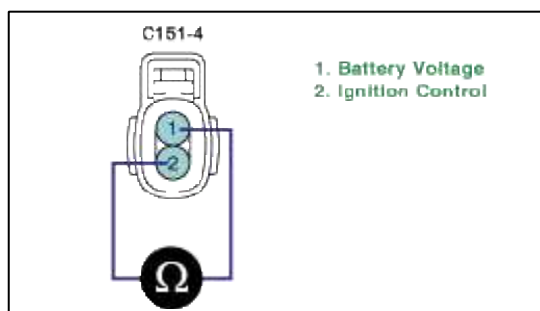
## CONTROL CIRCUIT INSPECTION

1. Check short to battery in harness.
  - (1) IG "OFF" and disconnect ignitioncoil connector and ECM connector.
  - (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

---

Specification : Infinite

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Check short to ground in harness" as follows.

**NO**

Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

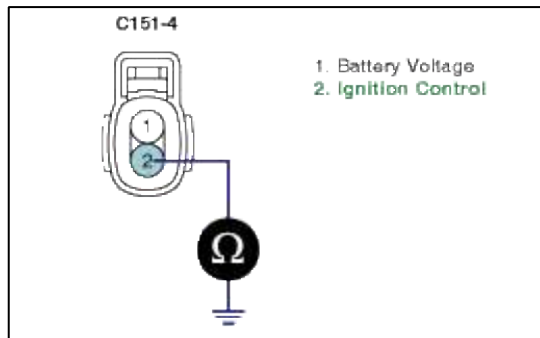
## 2. Check short to ground in harness

- (1) IG "OFF" and disconnect ignition coil connector and ECM connector.
- (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

---

Specification : Infinite

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Check open in harness" as follows.

**NO**

Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

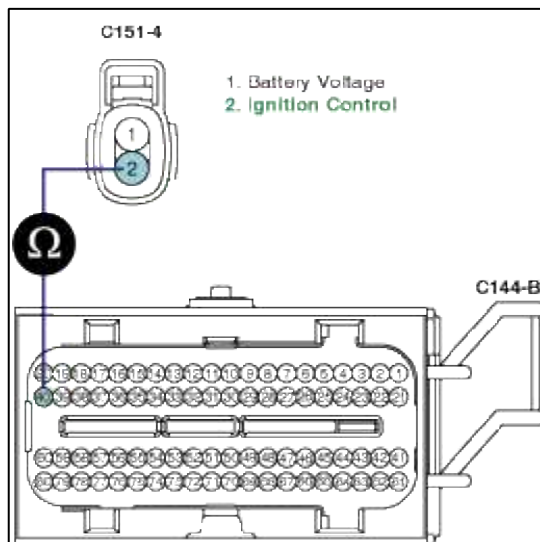
## 3. Check open in harness

- (1) IG "OFF" and disconnect Ignition Coil connector and ECM connector.
- (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 40 of ECM harness connector(C144-B).

---

Specification : Below 1Ω

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

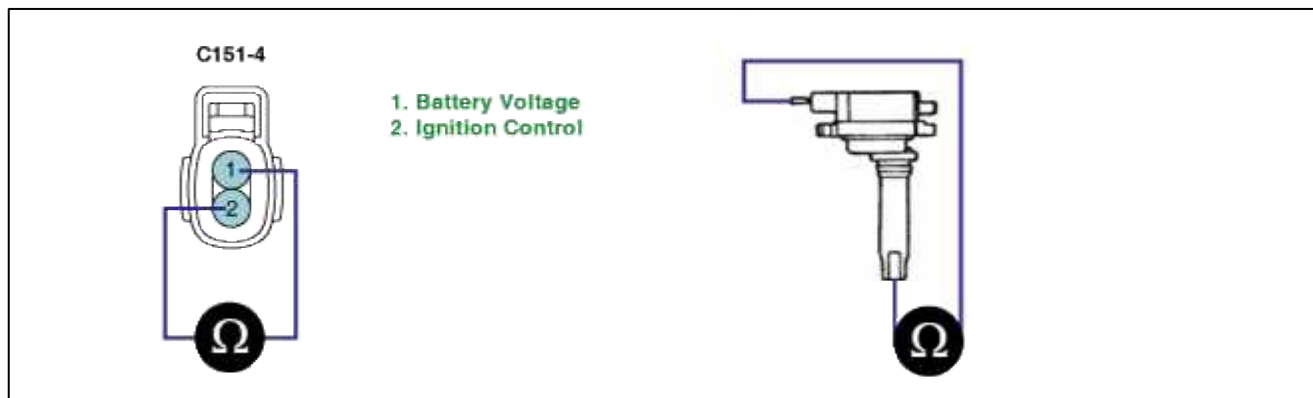
## COMPONENT INSPECTION

## 1. Check Ignition Coil

- (1) IG "OFF" and disconnect ignition coil connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
- (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

**Specification :**

Resistance ( $\Omega$ )	Primary Coil (A)	Secondary Coil (B)
	$0.62 \pm 10\% (\Omega)$	$7.0 \pm 15\% (k\Omega)$



- (4) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good Ignition Coil and check for proper operation.

If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

**VERIFICATION OF VEHICLE REPAIR**

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

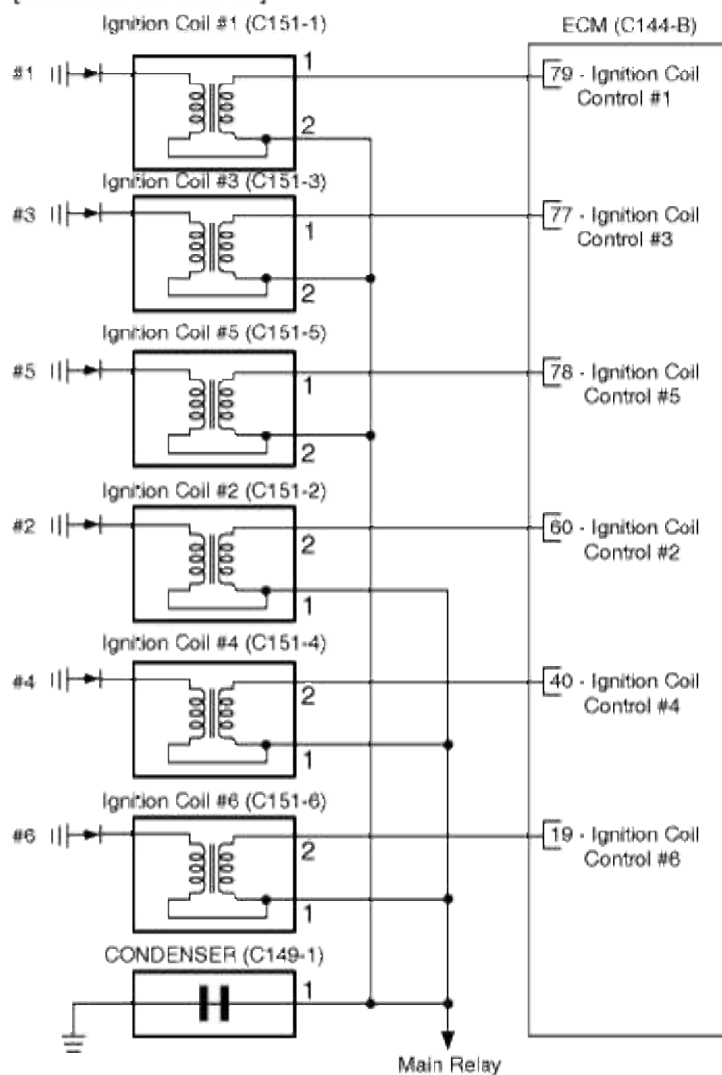
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

**SCHEMATIC DIAGRAM**

## [CIRCUIT DIAGRAM]



## [CONNECTOR INFORMATION]

## Ignition Coil #1

Terminal	Connected to	Function
1	ECM C144-B (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

## Ignition Coil #3

Terminal	Connected to	Function
1	ECM C144-B (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

## Ignition Coil #5

Terminal	Connected to	Function
1	ECM C144-B (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

## Ignition Coil #2

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (60)	Ignition Coil #2

## Ignition Coil #4

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (40)	Ignition Coil #4

## Ignition Coil #6

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (19)	Ignition Coil #6

## CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

## [HARNESS CONNECTOR]



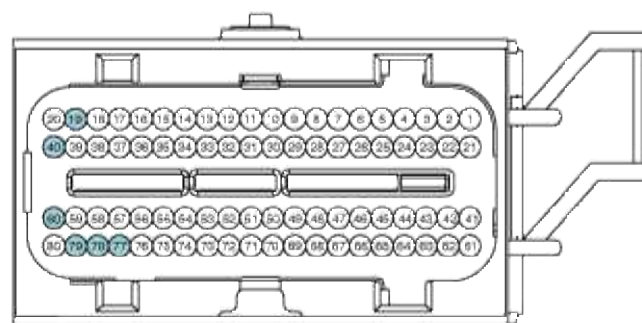
C151-1,2,3,4,5,6

Ignition Coil



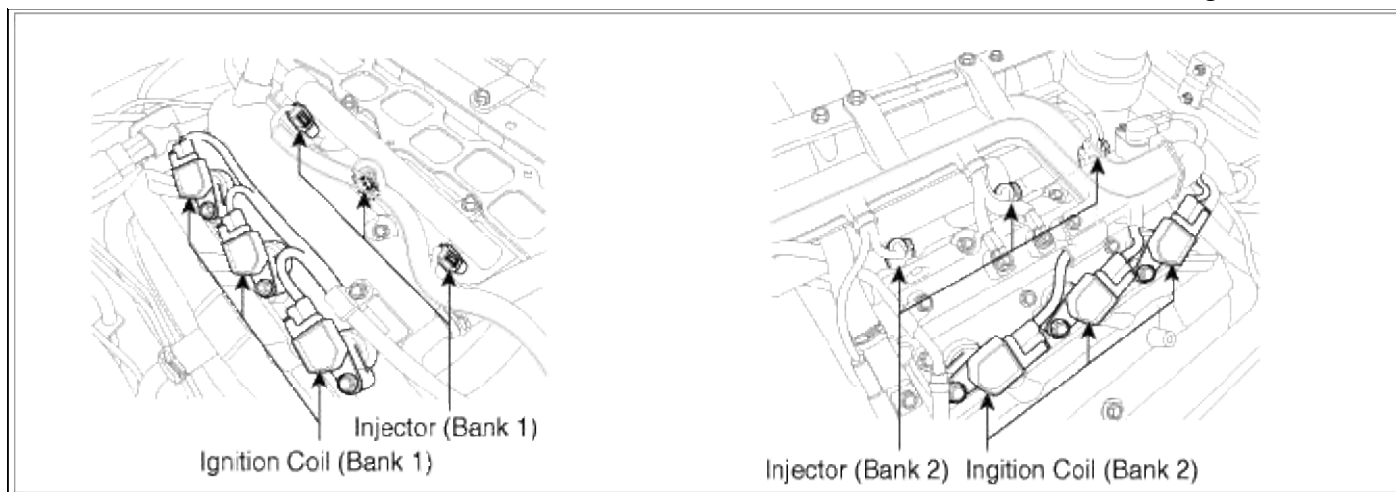
C149-1

CONDENSER

C144-B  
ECM

## Engine Electrical System &gt; Troubleshooting &gt; P0355

## COMPONENT LOCATION



## GENERAL DESCRIPTION

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for primary coil circuit control. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

## DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if the signals indicating open or short in the circuit are detected for more than 5 sec., ECM sets this DTC. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Detects a short to ground, to battery or open circuit</li> </ul>	<ul style="list-style-type: none"> <li>Poor connection</li> <li>Open or short in harness</li> <li>Ignition Coil</li> <li>ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>NO DTC related to this item</li> <li>Engine running</li> <li><math>11V \leq \text{Battery voltage} \leq 16V</math></li> <li>The above conditions are met <math>&gt; 0.5</math> sec.</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Open or short</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>Continuous (More than 5 sec.failure for every 10 sec.test)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

## (5) Is "Present" Fault displayed?

☐ **YES**

Go to "Terminal and connector inspection" procedure.

☐ **NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

☐ **YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

☐ **NO**

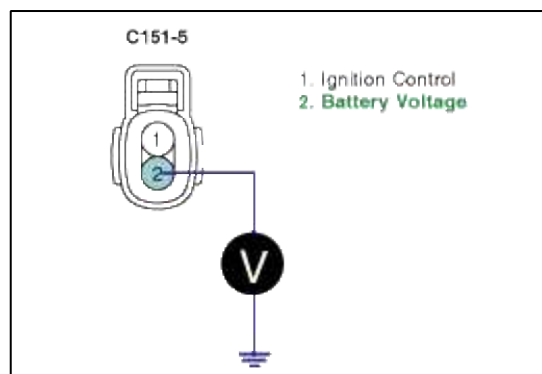
Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSEPTION

## 1. Check voltage

- (1) IG "OFF" and disconnect Ignition Coil connector.
- (2) IG "ON" and ENG "OFF"
- (3) Measure voltage between terminal 2 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



- (4) Is the measured voltage within specification ?

**YES**

Go to "Control Circuit Inspection" procedure.

**NO**

Check fuse connected to ignition coil for open.

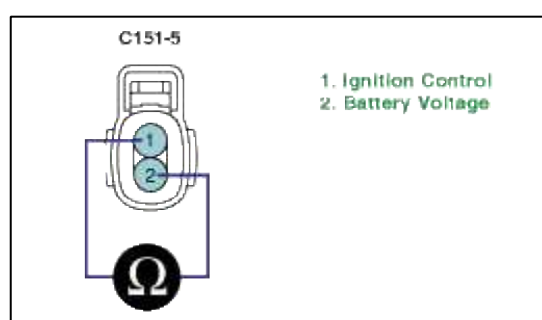
Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

## CONTROL CIRCUIT INSPECTION

## 1. Check short to battery in harness.

- (1) IG "OFF" and disconnect ignitioncoil connector and ECM connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



- (3) Is the measured resistance within specification?

**YES**

Go to "Check short to ground in harness" as follows.

**NO**

Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.



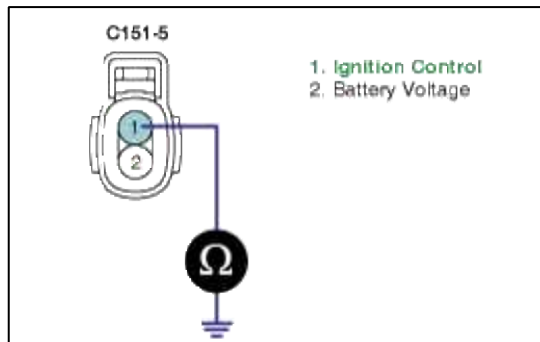
## 2. Check short to ground in harness

- (1) IG "OFF" and disconnect ignition coil connector and ECM connector.
- (2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

---

Specification : Infinite

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Check open in harness" as follows.

**NO**

Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

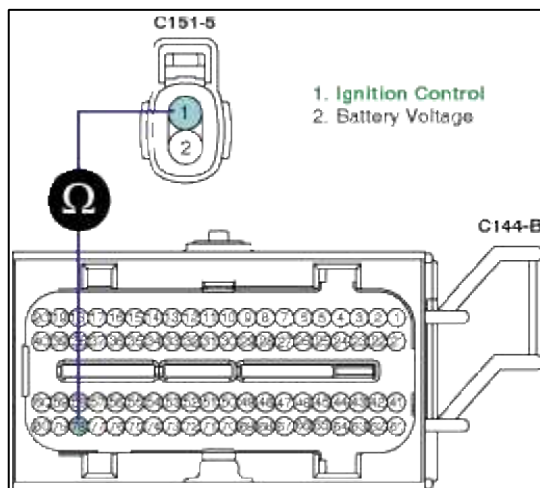
## 3. Check open in harness

- (1) IG "OFF" and disconnect Ignition Coil connector and ECM connector.
- (2) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 78 of ECM harness connector(C144-B).

---

Specification : Below 1Ω

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

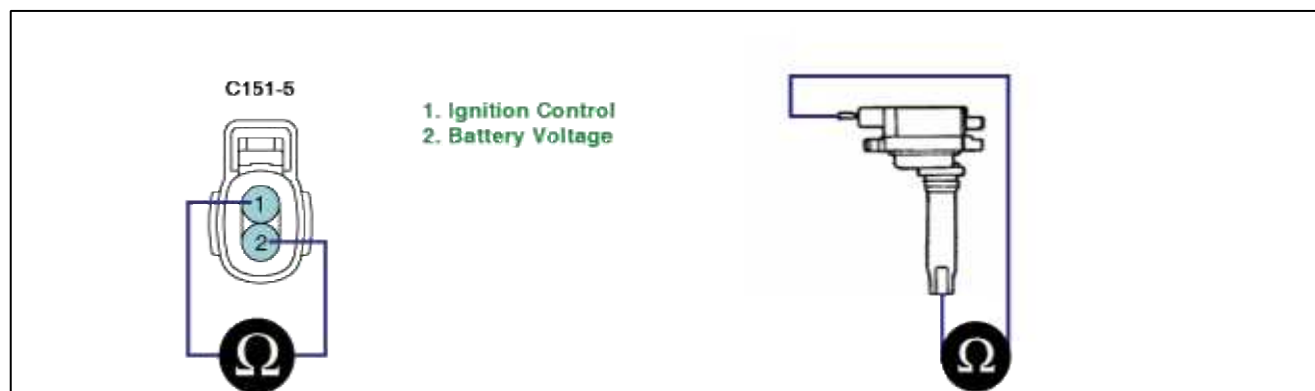
## COMPONENT INSPECTION

## 1. Check Ignition Coil

- (1) IG "OFF" and disconnect ignition coil connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
- (3) Measure resistance between terminal 2 of ignition coil connector and out terminal of secondary ignition coil.

### Specification :

Resistance ( $\Omega$ )	Primary Coil (A)	Secondary Coil (B)
	$0.62 \pm 10\% (\Omega)$	$7.0 \pm 15\% (k\Omega)$



- (4) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good Ignition Coil and check for proper operation.

If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

### NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

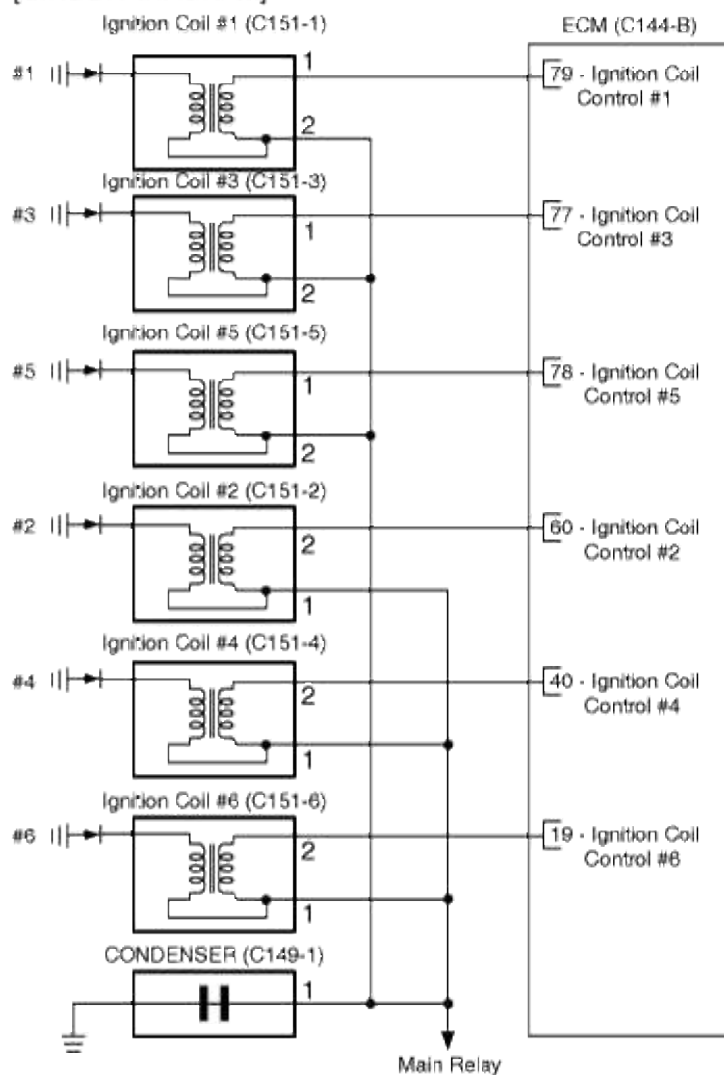
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## SCHEMATIC DIAGRAM

## [CIRCUIT DIAGRAM]



## [CONNECTOR INFORMATION]

## Ignition Coil #1

Terminal	Connected to	Function
1	ECM C144-B (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

## Ignition Coil #3

Terminal	Connected to	Function
1	ECM C144-B (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

## Ignition Coil #5

Terminal	Connected to	Function
1	ECM C144-B (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

## Ignition Coil #2

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (60)	Ignition Coil #2

## Ignition Coil #4

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (40)	Ignition Coil #4

## Ignition Coil #6

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (19)	Ignition Coil #6

## CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

## [HARNESS CONNECTOR]



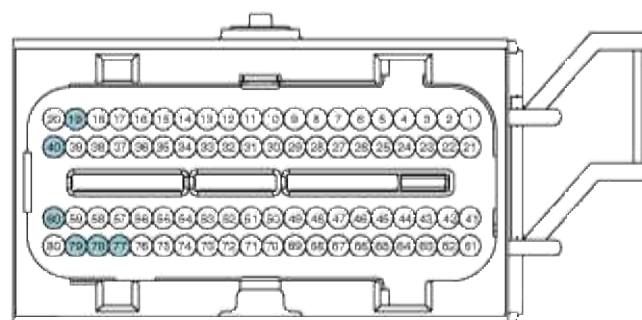
C151-1,2,3,4,5,6

Ignition Coil



C149-1

CONDENSER

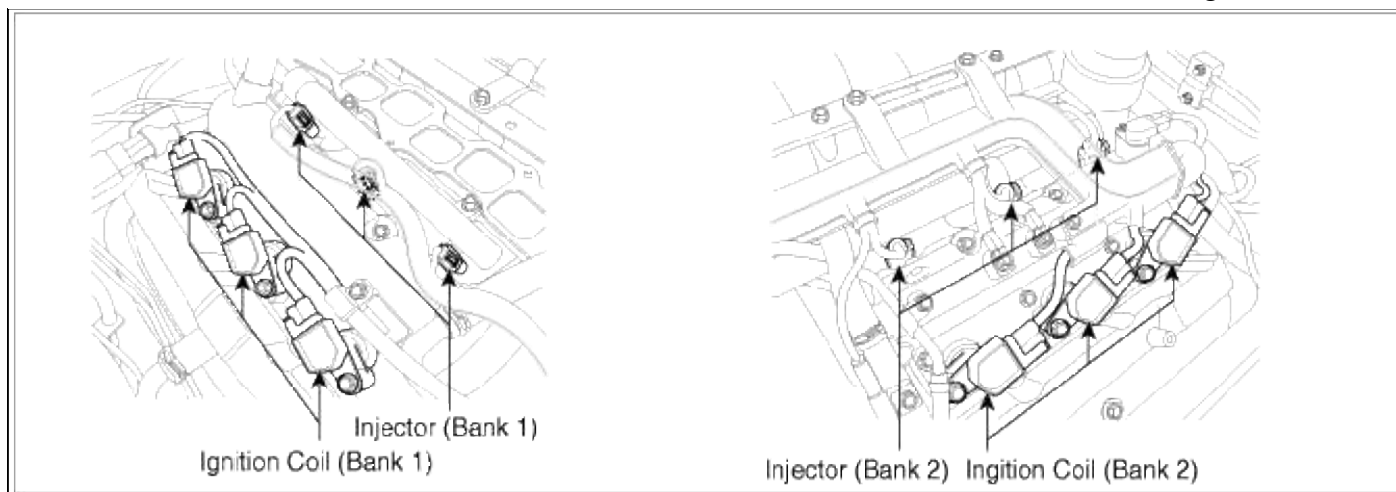


C144-B

ECM

## Engine Electrical System &gt; Troubleshooting &gt; P0356

## COMPONENT LOCATION



## GENERAL DESCRIPTION

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for primary coil circuit control. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

## DTC DESCRIPTION

Checking output signals from ignition coils every 10 sec. under detecting condition, if the signals indicating open or short in the circuit are detected for more than 5 sec., ECM sets this DTC. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Detects a short to ground, to battery or open circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open or short in harness</li> <li>• Ignition Coil</li> <li>• ECM</li> </ul>
EnableConditions	<ul style="list-style-type: none"> <li>• NO DTC related to this item</li> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> <li>• The above conditions are met <math>&gt; 0.5</math> sec.</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Open or short</li> </ul>	
DiagnosisTime	<ul style="list-style-type: none"> <li>• Continuous (More than 5 sec.failure for every 10 sec.test)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

## (5) Is "Present" Fault displayed?

☐ **YES**

Go to "Terminal and connector inspection" procedure.

☐ **NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

☐ **YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

☐ **NO**

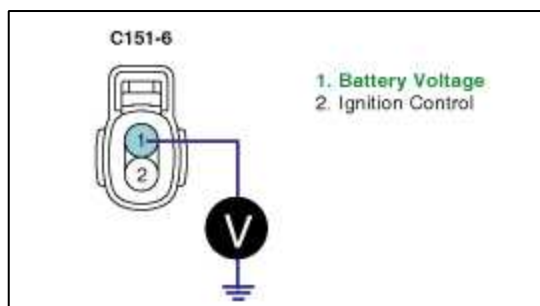
Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSEPTION

## 1. Check voltage

- (1) IG "OFF" and disconnect Ignition Coil connector.
- (2) IG "ON" and ENG "OFF"
- (3) Measure voltage between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Approx. B+



- (4) Is the measured voltage within specification ?

**YES**

Go to "Control Circuit Inspection" procedure.

**NO**

Check fuse connected to ignition coil for open.

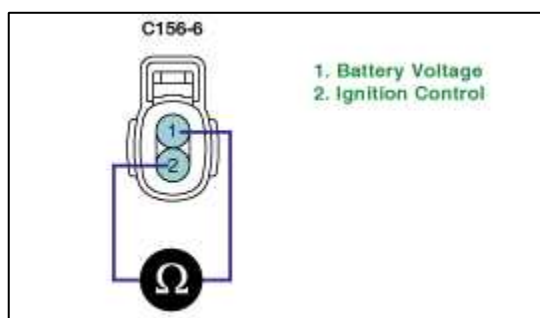
Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

## CONTROL CIRCUIT INSPECTION

## 1. Check short to battery in harness.

- (1) IG "OFF" and disconnect ignitioncoil connector and ECM connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil harness connector.

Specification : Infinite



- (3) Is the measured resistance within specification?

**YES**

Go to "Check short to ground in harness" as follows.

**NO**

Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

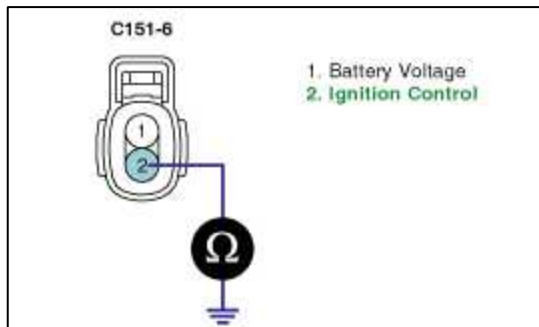
## 2. Check short to ground in harness

- (1) IG "OFF" and disconnect ignition coil connector and ECM connector.
- (2) Measure resistance between terminal 2 of ignition coil harness connector and chassis ground.

---

Specification : Infinite

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Check open in harness" as follows.

**NO**

Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

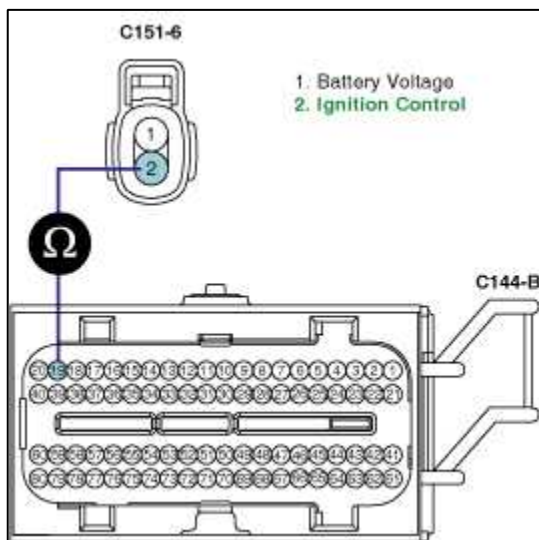
## 3. Check open in harness

- (1) IG "OFF" and disconnect Ignition Coil connector and ECM connector.
- (2) Measure resistance between terminal 2 of Ignition Coil harness connector and terminal 19 of ECM harness connector(C144-B).

---

Specification : Below 1Ω

---



- (3) Is the measured resistance within specification?

**YES**

Go to "Component Inspection" procedure.

**NO**

Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

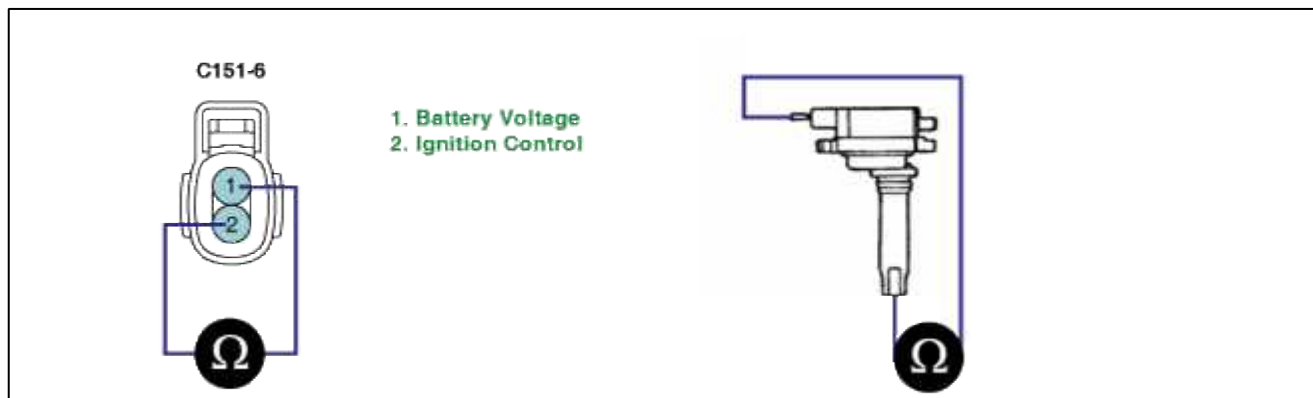
## COMPONENT INSPECTION

## 1. Check Ignition Coil

- (1) IG "OFF" and disconnect ignition coil connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
- (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary ignition coil.

**Specification :**

Resistance ( $\Omega$ )	Primary Coil (A)	Secondary Coil (B)
	$0.62 \pm 10\% (\Omega)$	$7.0 \pm 15\% (k\Omega)$



- (4) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation

If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good Ignition Coil and check for proper operation.

If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

**NOTE**

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

**VERIFICATION OF VEHICLE REPAIR**

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

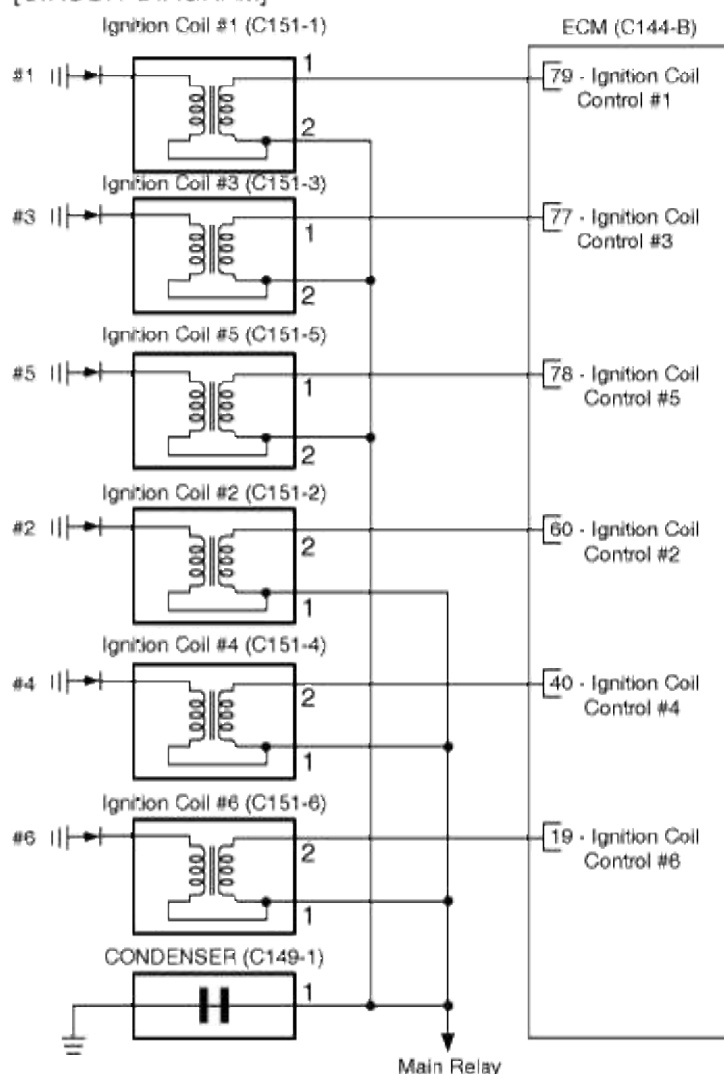
**NO**

Go to the applicable troubleshooting procedure.

**SCHEMATIC DIAGRAM**



## [CIRCUIT DIAGRAM]



## [HARNESS CONNECTOR]



C151-1,2,3,4,5,6

Ignition Coil



C149-1

CONDENSER

## [CONNECTOR INFORMATION]

## Ignition Coil #1

Terminal	Connected to	Function
1	ECM C144-B (79)	Ignition Coil #1
2	Main Relay	Battery (B+)

## Ignition Coil #3

Terminal	Connected to	Function
1	ECM C144-B (77)	Ignition Coil #3
2	Main Relay	Battery (B+)

## Ignition Coil #5

Terminal	Connected to	Function
1	ECM C144-B (78)	Ignition Coil #5
2	Main Relay	Battery (B+)

## Ignition Coil #2

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (60)	Ignition Coil #2

## Ignition Coil #4

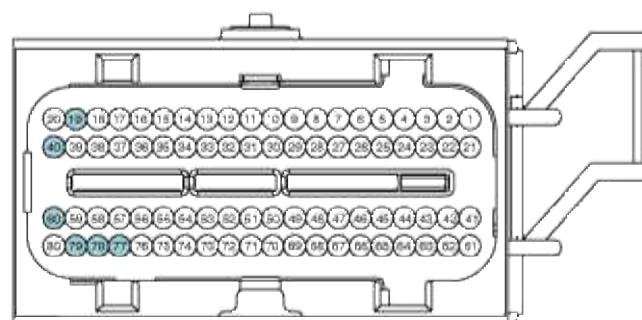
Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (40)	Ignition Coil #4

## Ignition Coil #6

Terminal	Connected to	Function
1	Main Relay	Battery (B+)
2	ECM C144-B (19)	Ignition Coil #6

## CONDENSER

Terminal	Connected to	Function
1	Main Relay	Power Supply (B+)

C144-B  
ECM

## Engine Electrical System &gt; Troubleshooting &gt; P050B

## GENERAL DESCRIPTION

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for primary coil circuit control. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

### DTC DESCRIPTION

Checking spark timing under detecting condition, if the actual spark timing differs from the commanded spark timing, ECM sets this DTC. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Monitor the spark timing</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty Ignition Coil</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>• NoAfter engine overnight soaking</li> <li>• Vehicle is not rapidly accelerating or decelerating.</li> <li>• 11V&lt; Battery Voltage &lt; 16V</li> <li>• Engine is running.</li> <li>• NO DTC related to CKPS,Ignition coil, and Misfire</li> </ul>	
Thresh old value	<ul style="list-style-type: none"> <li>• The actual spark timing &gt; the commanded spark timing + 15° or &lt; the commanded spark timing -15°</li> </ul>	
Diagnosis Time	<ul style="list-style-type: none"> <li>• Within 1 minute after cold-starting</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• 2 driving cycles</li> </ul>	

## MONITOR DTC STATUS

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<b>1.1 DIAGNOSTIC TROUBLE CODES</b>		
<div style="background-color: black; color: white; padding: 2px 5px;"><b>PXXXX DTC TITLE</b></div> <div style="height: 150px; border: 1px solid black; margin-top: 5px;"></div>		
<b>NUMBER OF DTC : 1 ITEMS</b>		
<b>PART</b>	<b>ERAS</b>	<b>DTAL</b>

<b>PXXXX TITLE</b>	
<b>1.MIL STATUS:</b> <b>2.DTC STATUS:</b> <b>3.DIAG.STATUS:</b>	<b>ON/OFF</b> <b>PRESENT/HISTORY</b> <b>DIAGNOSIS FINISHED</b>
<b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b>	

- (5) Is "Present" Fault displayed?

**YES**

Go to "Component Inspection" procedure.

NO

Fault is intermittent caused by ECM memory was not cleared after repair. Erase DTC and drive the vehicle satisfy the enable condition then, go to " System Inspection" procedure.

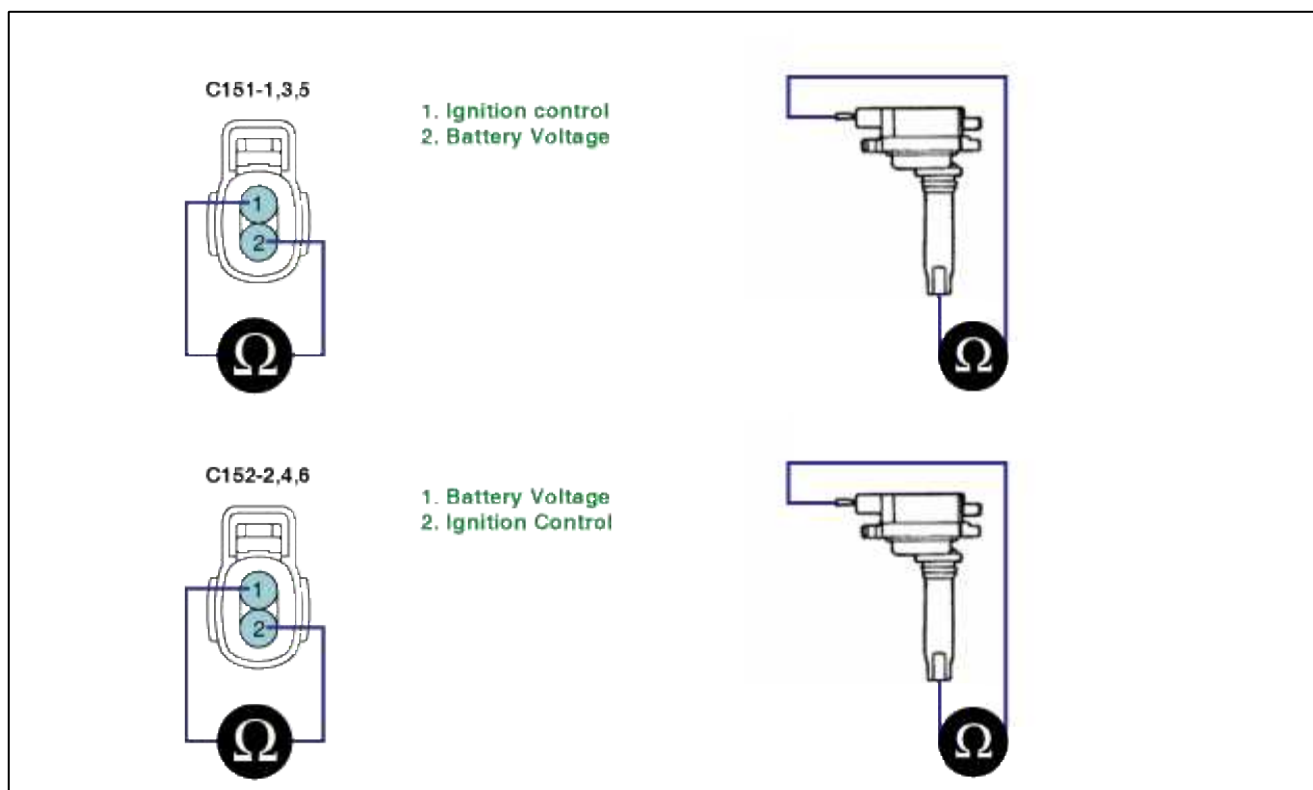
## COMPONENT INSPECTION

### 1. Check Ignition Coil

- (1) IG "OFF" and disconnect ignition coil connector.
- (2) Measure resistance between terminals 1 and 2 of ignition coil connector.(Component side)
- (3) Measure resistance between terminal 1 of ignition coil connector and out terminal of secondary

#### Specification :

Resistance	Primary Coil	Secondary Coil
	$0.62\Omega \pm 10\%$	$7.0k\Omega \pm 15\%$



- (4) Is the measured resistance within specification?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good Ignition Coil and check for proper operation. If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter

4. Is "History (Not Present)" fault displayed?

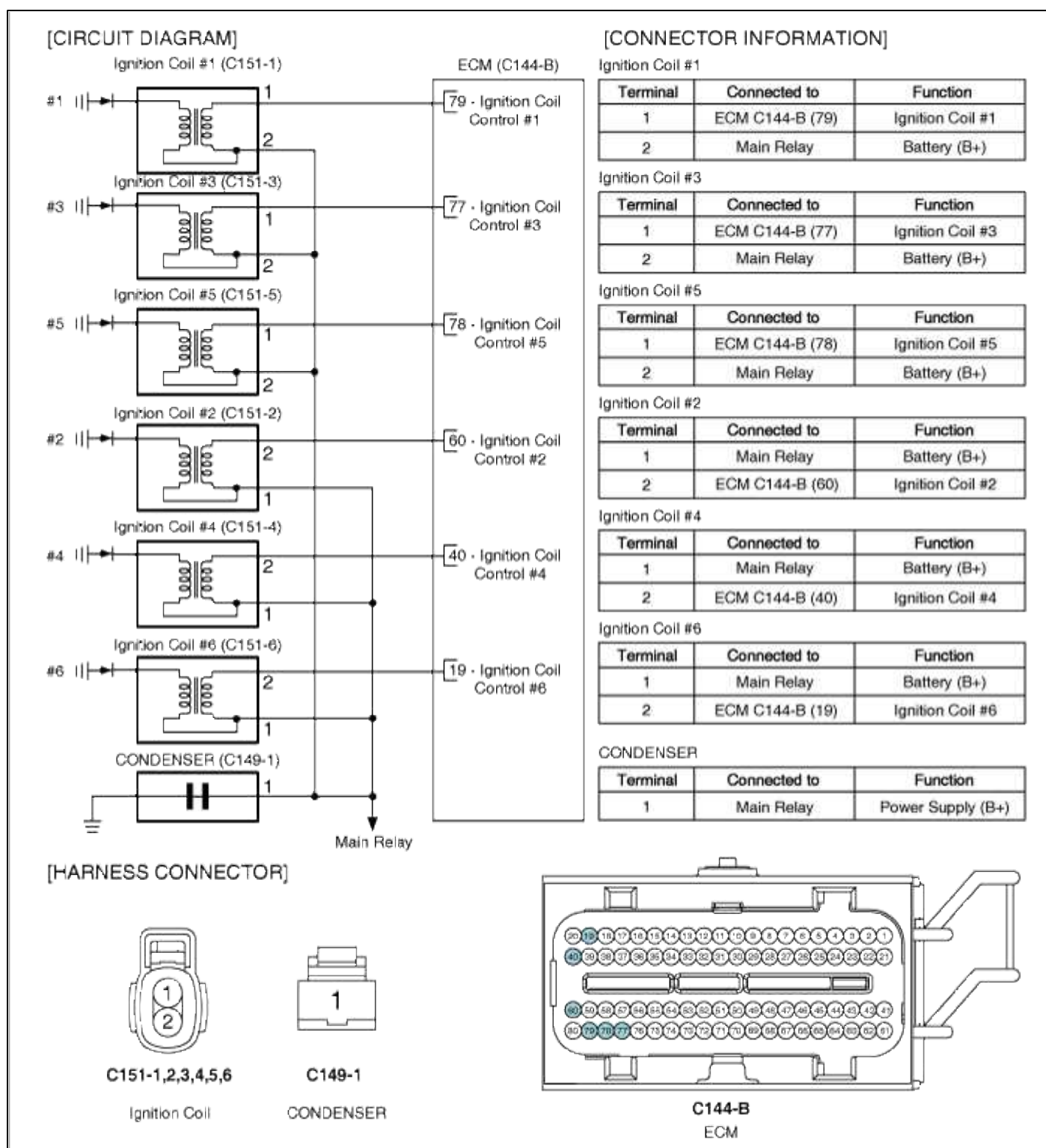
**YES**

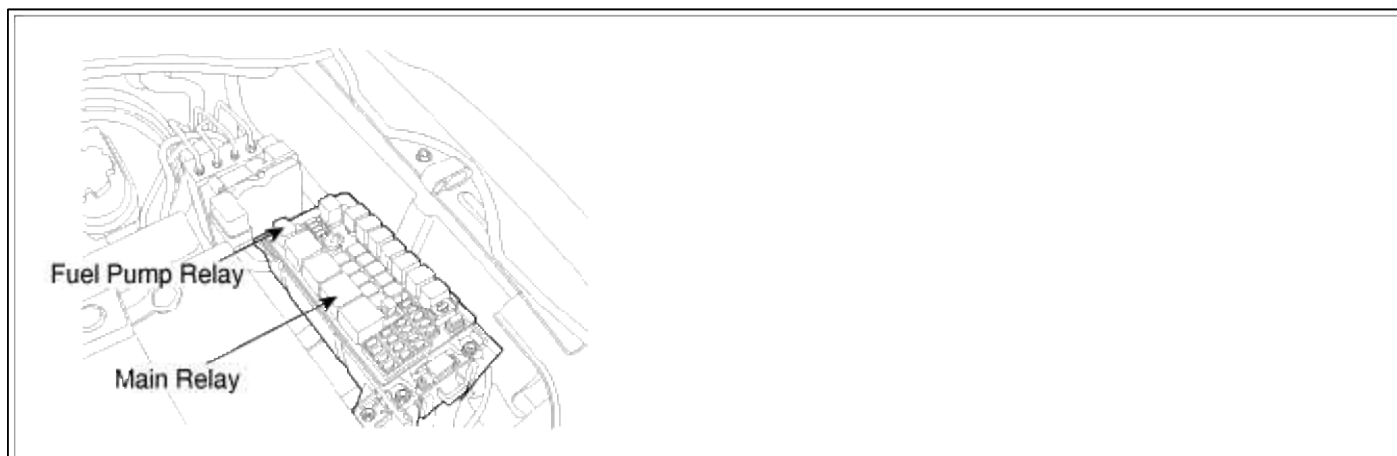
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

## SCHEMATIC DIAGRAM





### GENERAL DESCRIPTION

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

### DTC DESCRIPTION

If system voltage is below 11V, ECM sets P0562. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage too low	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open in power circuit</li> <li>• Faulty charging system</li> <li>• Faulty main relay</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> </ul>	
Thresh old value	• System voltage < 11V	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

### MONITOR DTC STATUS

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

## (5) Is "Present" Fault displayed?

☐ **YES**

Go to "Terminal and connector inspection" procedure.

☐ **NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

☐ **YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

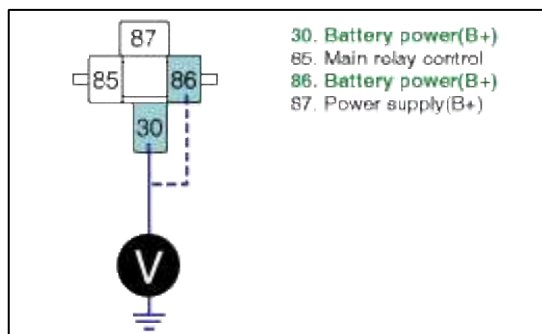
☐ **NO**

Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSPECTION

1. Check voltage
  - (1) IG "OFF".
  - (2) Disconnect the main relay.
  - (3) IG "ON" and ENG "OFF"
  - (4) Measure the voltage between terminal 30 of main relay harness connector and chassis ground.
  - (5) Measure the voltage between terminal 86 of main relay harness connector and chassis ground.

Specification : B+



- (6) Is the measured voltage within specification ?

**YES**

Go to "Check open in harness" procedure.

**NO**

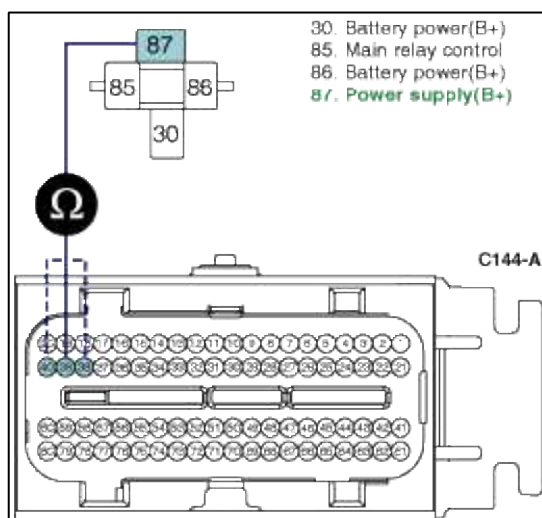
Check the fuse between battery and main relay.

Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure

2. Check open in harness

- (1) IG "OFF".
- (2) Disconnect main relay and ECM connector.
- (3) Measure the resistance between terminal 87 of main relay harness connector and terminals 38, 39, 40 of ECM harness connector(C144-A).

Specification : Approx. below 1Ω



(4) Is the measured resistance within specification ?

**YES**

Go to "Check short in harness" procedure.

**NO**

Repair open in harness and go to "Verification of Vehicle Repair" procedure .

### 3. Check short in harness

(1) IG "OFF".

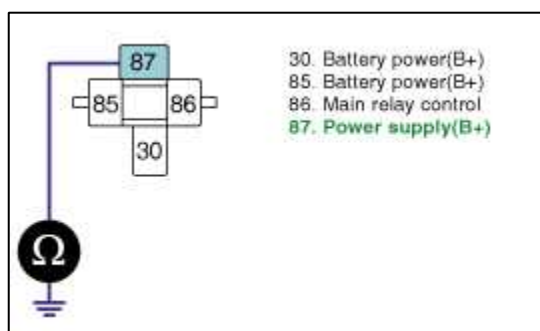
(2) Disconnect main relay and ECM connector.

(3) Measure the resistance between terminal 87 of main relay harness connector and chassis ground.

---

Specification : Infinite

---



(4) Is the measured resistance within specification ?

**YES**

Go to "Control circuit inspection" procedure.

**NO**

Repair short in harness and go to "Verification of Vehicle Repair" procedure.

### CONTROL CIRCUIT INSPECTION

#### 1. Check short in harness

(1) IG "OFF".

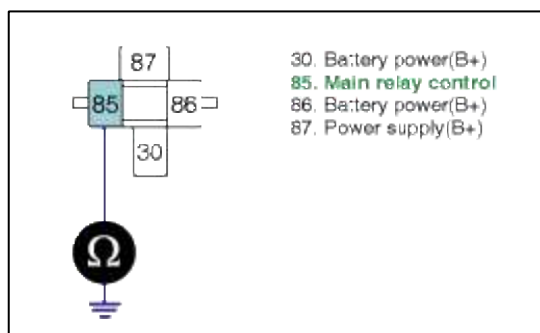
(2) Disconnect main relay and ECM connector.

(3) Measure the resistance between terminal 85 of main relay harness connector and chassis ground.

---

Specification : Infinite

---



(4) Is the measured resistance within specification ?

**YES**

Go to "Check open in harness" procedure.

**NO**



(5) Repair short in control harness and go to "Verification of Vehicle Repair" procedure.

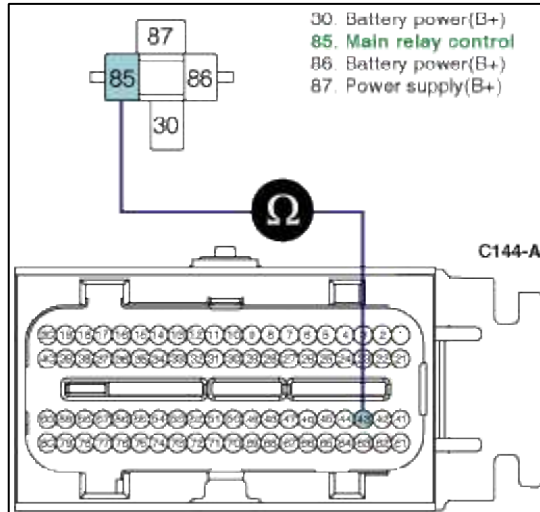
## 2. Check open in harness

- (1) IG "OFF".
- (2) Disconnect main relay and ECM connector.
- (3) Measure the resistance between terminal 85 of main relay harness connector and terminal 43 of ECM harness connector(C144-A).

---

Specification : Approx. below 1Ω

---



(4) Is the measured resistance within specification ?

**YES**

Go to "System inspection" procedure.

**NO**

Repair open in control harness and go to "Verification of Vehicle Repair" procedure.

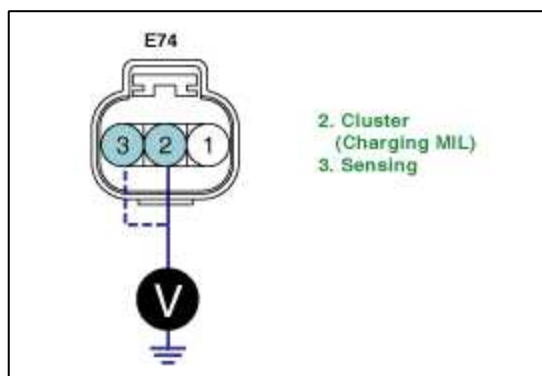
## SYSTEM INSPECTION

### 1. Check Alternator circuit

- (1) IG "OFF".
- (2) Disconnect alternator connector.
- (3) IG "ON".
- (4) Measure the voltage between terminal 2 of alternator and chassis ground.

(5) Measure the voltage between terminal 3 of alternator and chassis ground.

Specification : B+



(6) Is the measured voltage within specification?

**YES**

Go to "Component inspection" procedure.

**NO**

In case terminal 2 : Repair MIL circuit, MIL resistor or Open in circuit and go to "Verification of Vehicle Repair" procedure.

In case terminal 3 : Repair the fuse between battery and Ignition switch, the fuse between Ignition switch and alternator or Open in circuit and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. Check Main relay

(1) IG "OFF".

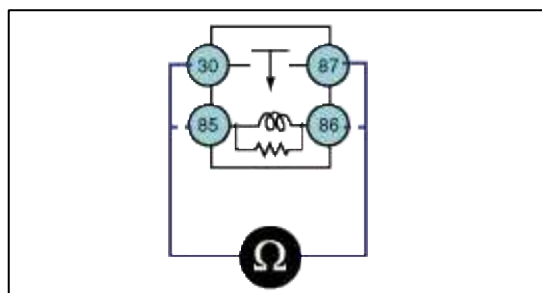
(2) Disconnect the main relay.

(3) Measure the resistance between terminal 30 and 87 of main relay.

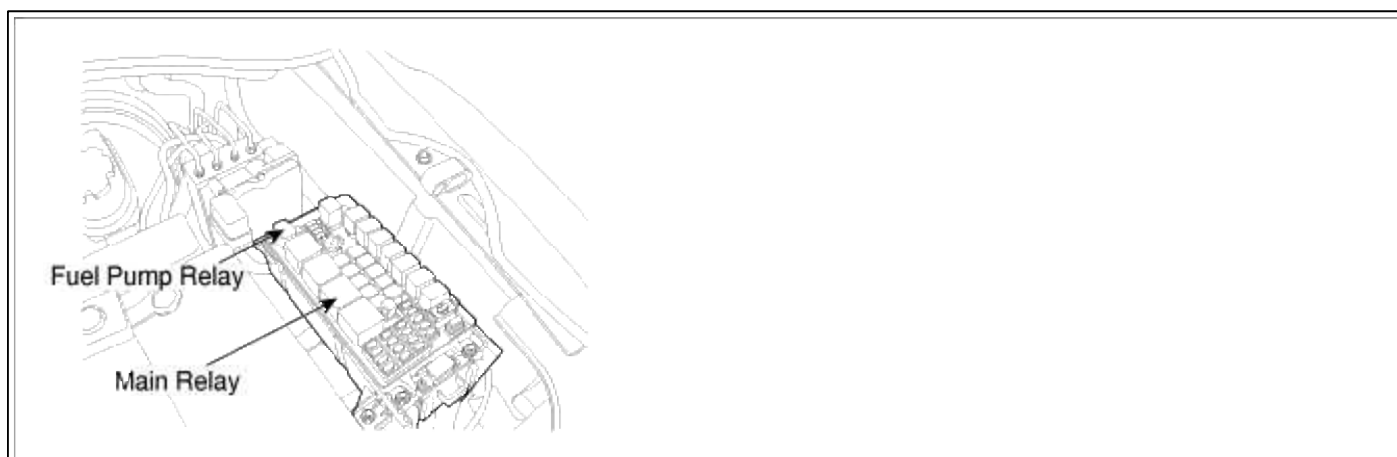
(4) Measure the resistance between terminal 85 and 86 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
30 ~ 87	NO
85 ~ 86	YES (Approx. 70Ω ~ 120Ω)





**Engine Electrical System > Troubleshooting > P0563****COMPONENT LOCATION****GENERAL DESCRIPTION**

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

**DTC DESCRIPTION**

If system voltage is above 16V, ECM sets P0563. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage too high	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Short in circuit</li> <li>• Faulty charging system</li> <li>• Faulty main relay</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	• Engine running	
Thresh old value	• System voltage >16V	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

**MONITOR DTC STATUS**

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">       </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
---	---

- (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

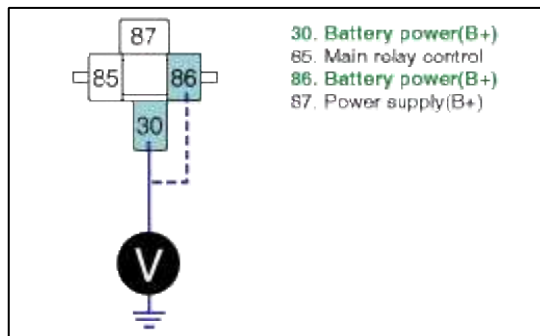
Go to " Power Circuit Inspection " procedure.

## POWER CIRCUIT INSPECTION

## 1. Power circuit inspection

- (1) IG "OFF".
- (2) Disconnect the main relay connector.
- (3) IG "ON" and ENG "OFF".
- (4) Measure the voltage between terminal 30 of main relay harness connector and chassis ground.
- (5) Measure the voltage between terminal 86 of main relay harness connector and chassis ground.

Specification : B+



- (6) Is the measured voltage within specification ?

**YES**

Go to "Check short in harness" procedure.

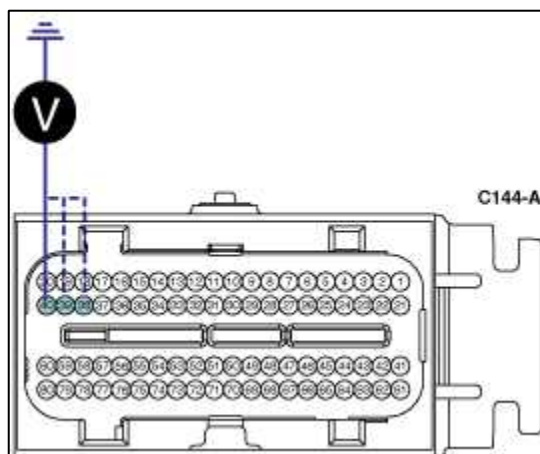
**NO**

Repair Short in power harness and go to "Verification of Vehicle Repair" procedure.

## 2. Check short in harness

- (1) IG "ON".
- (2) Measure the voltage between terminal 38, 39, 40 of ECM harness connector(C144-A) and chassis ground.

Specification : B+



- (3) Is the measured voltage within specification ?

**YES**

Go to "System inspection" procedure.

**NO**

Repair short in power harness and go to "Verification of Vehicle Repair" procedure .

## SYSTEM INSPECTION

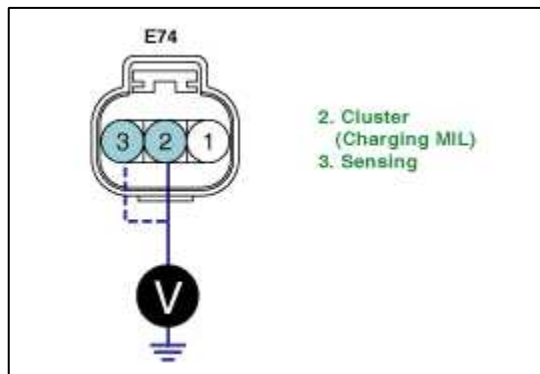
## 1. Check Alternator circuit

- (1) IG "OFF".
- (2) Disconnect alternator connector.
- (3) IG "ON" and ENG "OFF"
- (4) Measure the voltage between terminal 2 of alternator and chassis ground.
- (5) Measure the voltage between terminal 3 of alternator and chassis ground.

---

Specification : B+

---



- (6) Is the measured voltage within specification?

**YES**

Go to "Component inspection" procedure.

**NO**

Repair short in Sensing circuit or MIL circuit and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check Main relay

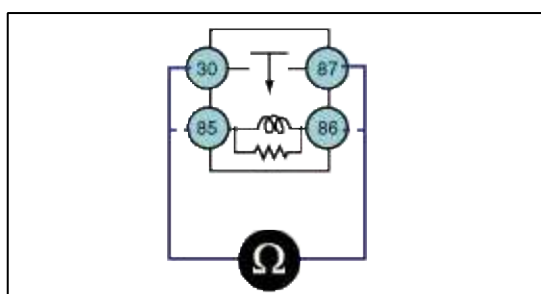
- (1) IG "OFF".
- (2) Disconnect the main relay.
- (3) Measure the resistance between terminal 30 and 87 of main relay.
- (4) Measure the resistance between terminal 85 and 86 of main relay.

---

Specification : 70 ~ 120Ω

---

Terminal	Power approval
30 ~ 87	NO
85 ~ 86	YES (Approx. 70Ω ~ 120Ω)



(5) Is the measured resistance within specification ?

**YES**

Go to "Check Alternator" procedure.

**NO**

Substitute with a known - good Main relay and check for proper operation. If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

## 2. Check Alternator

(1) IG "OFF".

(2) Check the tension of the belt.

(3) Check Battery terminal and Alternator B+ terminal for looseness, corrosion or damage.

(4) Engine "ON".

(5) Operate electric equipments (Head lamp, Hot wire, etc).

(6) accelerate engine to 2000 RPM and measure the battery voltage.

---

Specification : Approx. 12.5V ~ 14.5V

---

(7) Is the measured voltage within specification ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good Alternator and check for proper operation. If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

### NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

System performing to specification at this time. Clear the DTC

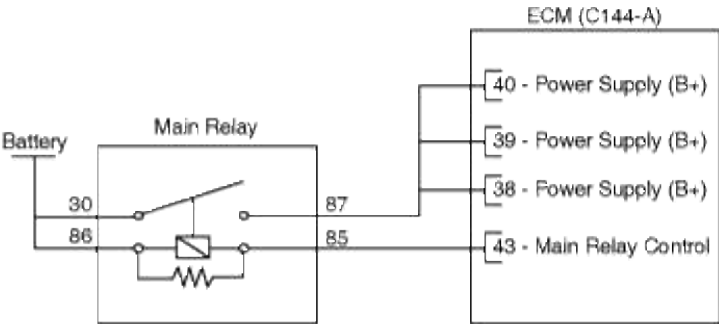
**NO**

Go to the applicable troubleshooting procedure.

## SCHEMATIC DIAGRAM



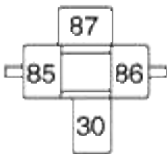
[CIRCUIT DIAGRAM]



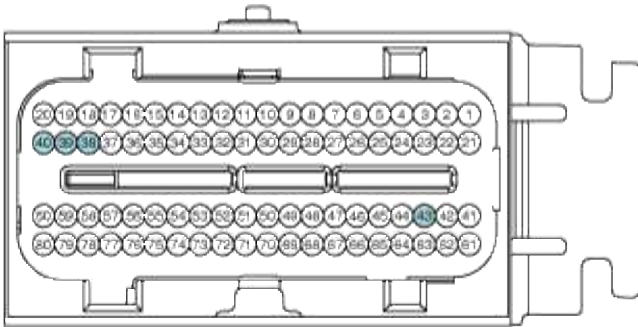
[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Power (B+)
85	ECM C144-A (43)	Main Relay Control
86	Battery	Battery Power (B+)
87	ECM C144-A (38)	Power Supply (B+)
	ECM C144-A (39)	
	ECM C144-A (40)	

[HARNESS CONNECTOR]

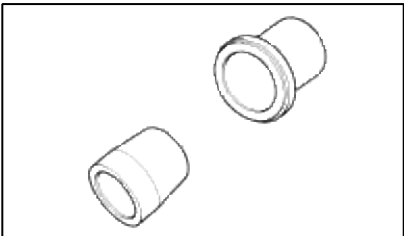
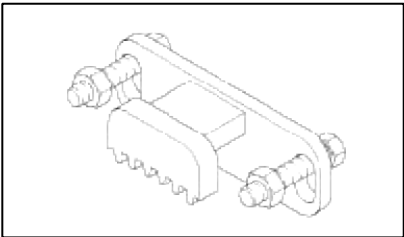
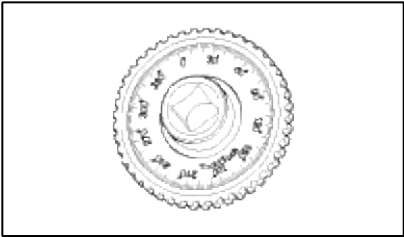
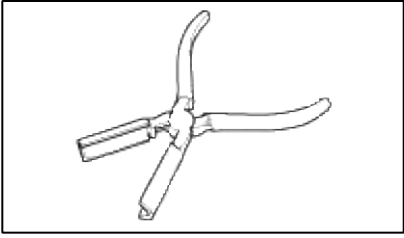
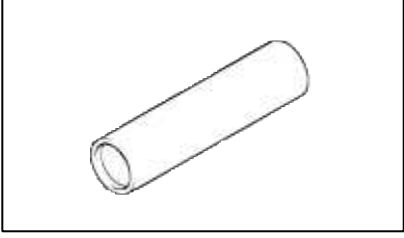
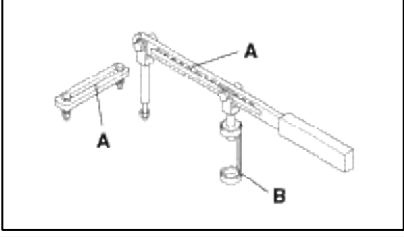


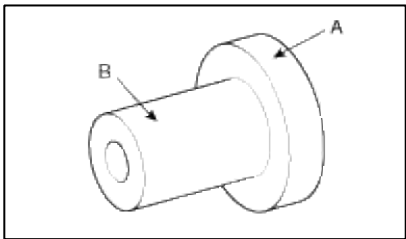
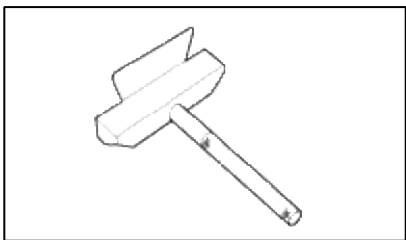
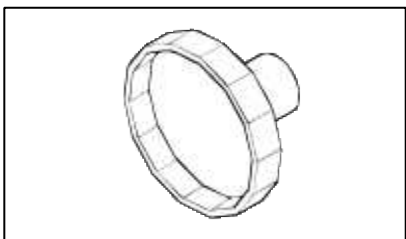
Main Relay



C144-A  
ECM

**SORENTO(BL) > 2007 > G 3.3 DOHC > Engine Mechanical System****Engine Mechanical System > General Information > Special Service Tools****SPECIAL SERVICE TOOLS**

<b>Tool (Number and name)</b>	<b>Illustration</b>	<b>Use</b>
Crankshaft front oil seal installer (09231-3C100)		Installation of the front oil seal
Flywheel stopper (09231-3C300)		Removal and installation of the flywheel and crankshaft pulley.
Torque angle adapter (09221-4A000)		Installation of bolts and nuts needing an angular method
Valve stem seal remover (09222-29000)		Remover of the valve stem seal
Valve stem seal remover (09222-3C100)		Installation of the valve stem seal
Valve spring compressor & holder (09222-3K000) (09222-3C300)		Removal and installation of the intake or exhaust valve A : 09222-3K000 B : 09222-3C300 (holder)

Crankshaft rear oil seal installer (09231-3C200) (09231-H1100)		Installation of the crankshaft rear oil seal A : 09231-3C200 B : 09231-H1100
Oil pan remover (09215-3C000)		Removal of oil pan
Oil filter wrench (09263-3C100)		Removal and installation of the oil filter

### Engine Mechanical System > General Information > Troubleshooting

#### TROUBLESHOOTING

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Worn crankshaft bearings. Loose or improperly installed engine drive plate.	Replace the crankshaft and bearings as required. Repair or replace the drive plate as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required.
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant consumption.	<ul style="list-style-type: none"> <li>Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system.</li> <li>Coolant consumption may or may not cause the engine to overheat.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket.</li> <li>Repair or replace as required.</li> </ul>
Engine misfire with excessive oil	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.

consumption.	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	<ul style="list-style-type: none"> <li>• Inspect the cylinder for a loss of compression.</li> <li>• Repair or replace as required.</li> </ul>
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity.	<ul style="list-style-type: none"> <li>• Drain the oil.</li> <li>• Install the correct viscosity oil.</li> </ul>
	Worn crankshaft thrust bearing.	<ul style="list-style-type: none"> <li>• Inspect the thrust bearing and crankshaft.</li> <li>• Repair or replace as required.</li> </ul>
Upper engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	<ul style="list-style-type: none"> <li>• Inspect the camshaft lobes.</li> <li>• Replace the timing camshaft and valve lifters as required.</li> </ul>
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
	Worn drive belt, idler, tensioner and bearing.	Replace as required.
Lower engine noise, regardless of engine speed.	Low oil pressure.	Repair or required.
	Loose or damaged drive plate.	Repair or replace the drive plate.
	Damaged oil pan, contacting the oil pump screen.	<ul style="list-style-type: none"> <li>• Inspect the oil pan.</li> <li>• Inspect the oil pump screen.</li> <li>• Repair or replace as required.</li> </ul>
	Oil pump screen loose, damaged or restricted.	<ul style="list-style-type: none"> <li>• Inspect the oil pump screen.</li> <li>• Repair or replace as required.</li> </ul>
	Excessive piston-to-cylinder bore clearance.	<ul style="list-style-type: none"> <li>• Inspect the piston, piston pin and cylinder bore.</li> <li>• Repair as required.</li> </ul>
	Excessive piston pin-to-piston clearance.	<ul style="list-style-type: none"> <li>• Inspect the piston, piston pin and the connecting rod.</li> <li>• Repair or replace as required.</li> </ul>
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required. <ul style="list-style-type: none"> <li>• The connecting rod bearings.</li> <li>• The connecting rods.</li> <li>• The crankshaft pin journals.</li> </ul>
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair

		as required. <ul style="list-style-type: none"> <li>• The crankshaft bearings.</li> <li>• The crankshaft main journals.</li> <li>• The cylinder block.</li> </ul>
	Incorrect piston, piston pin and connecting rod installation	<ul style="list-style-type: none"> <li>• Verify the piston pins and connecting rods are installed correctly.</li> <li>• Repair as required.</li> </ul>
Engine noise under load.	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance .	Inspect the following components and repair as required : <ul style="list-style-type: none"> <li>• The connecting rod bearings.</li> <li>• The connecting rods.</li> <li>• The crankshaft.</li> </ul>
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair as required. <ul style="list-style-type: none"> <li>• The crankshaft bearings.</li> <li>• The crankshaft main journals.</li> <li>• The cylinder block.</li> </ul>
Engine will not crank- crankshaft will not rotate.	Hydraulically locked cylinder. <ul style="list-style-type: none"> <li>• Coolant/antifreeze in cylinder.</li> <li>• Oil in cylinder.</li> <li>• Fuel in cylinder.</li> </ul>	<ol style="list-style-type: none"> <li>1. Remove spark plugs and check for fluid.</li> <li>2. Inspect for broken head gasket.</li> <li>3. Inspect for cracked engine block or cylinder head.</li> <li>4. Inspect for a sticking fuel injector and/or leaking fuel regulator.</li> </ol>
	Broken timing chain and/or timing chain and/or timing chain gears.	<ol style="list-style-type: none"> <li>1. Inspect timing chain and gears.</li> <li>2. Repair as required.</li> </ol>
	Material in cylinder. <ul style="list-style-type: none"> <li>• Broken valve</li> <li>• Piston material</li> <li>• Foreign material</li> </ul>	<ol style="list-style-type: none"> <li>1. Inspect cylinder for damaged components and/or foreign materials.</li> <li>2. Repair or replace as required.</li> </ol>
	Seized crankshaft or connecting rod bearings.	<ol style="list-style-type: none"> <li>1. Inspect crankshaft and connecting rod bearing.</li> <li>2. Repair as required.</li> </ol>
	Bent or broken connecting rod.	<ol style="list-style-type: none"> <li>1. Inspect connecting rods.</li> <li>2. Repair as required.</li> </ol>
	Broken crankshaft.	<ol style="list-style-type: none"> <li>1. Inspect crankshaft.</li> <li>2. Repair as required.</li> </ol>

**Engine Mechanical System > General Information > Repair procedures**

INSPECTION

COMPRESSION PRESSURE

**NOTE**

If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. Warm up and stop engine.  
Allow the engine to warm up to normal operating temperature.
2. Remove ignition coils. (Refer to Ignition in FL Group)
3. Remove spark plugs.  
Using a 16mm plug wrench, remove the 6 spark plugs.
4. Check cylinder compression pressure.
  - A. Insert a compression gauge into the spark plug hole.
  - B. Fully open the throttle.
  - C. After 7 times of cranking the engine, measure the compression pressure.

**NOTE**

Always use a fully charged battery to obtain engine speed of 200 rpm or more.

- D. Repeat steps (a) through (c) for each cylinder.

**NOTE**

This measurement must be done in as short a time as possible.

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Compression pressure :

1,225kPa (12.5kgf/cm<sup>2</sup>, 177psi) - 200 ~ 250rpm

Minimum pressure :

1,078kPa (11.0kgf/cm<sup>2</sup>, 156psi)

Difference between each cylinder :

98kPa (1.0kg/cm<sup>2</sup>, 14psi) or less

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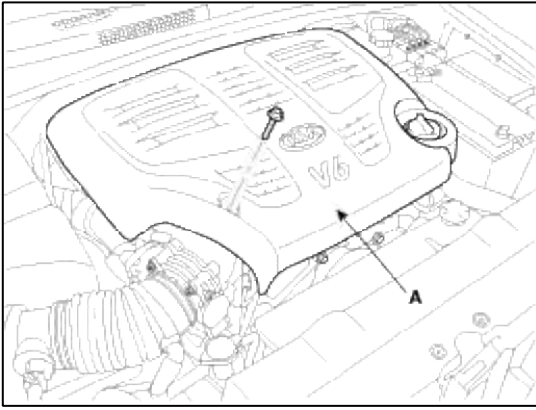
- E. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
  - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
  - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.
5. Reinstall spark plugs.
6. Install ignition coils. (See EE group - ignition)

## VALVE CLEARANCE INSPECTION AND ADJUSTMENT

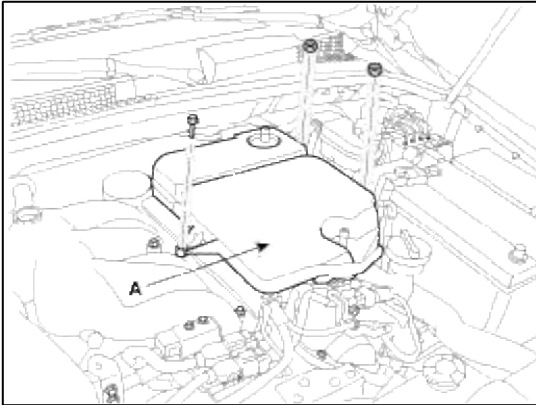
**NOTE**

Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C) and cylinder head is installed on the cylinder block.

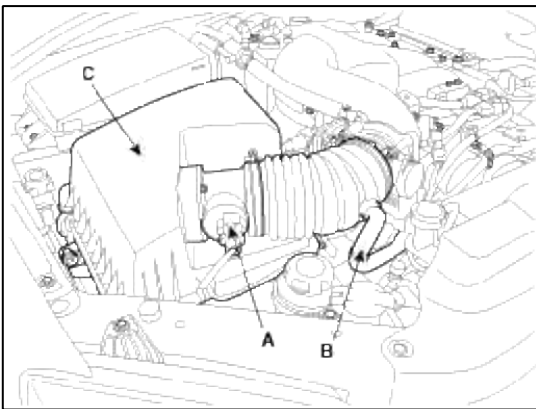
1. Remove the engine cover(A).



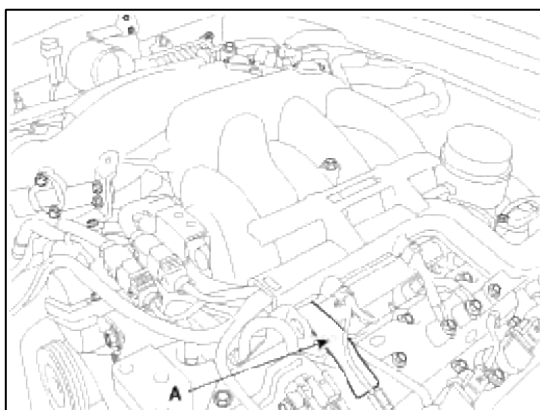
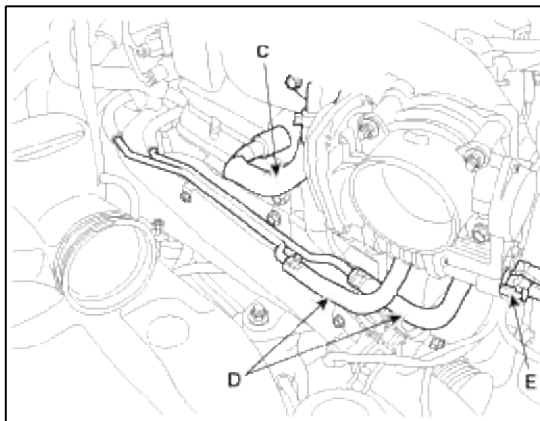
2. Remove the engine room resonator(A).



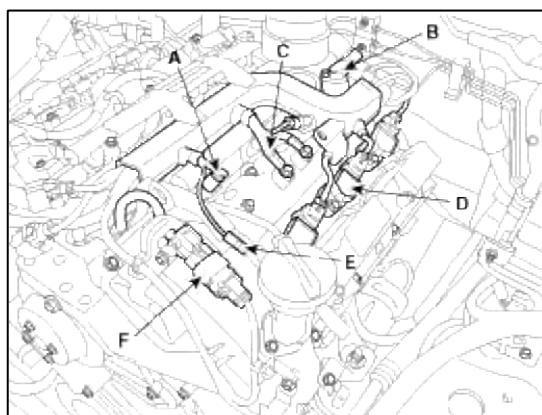
3. After disconnecting the MAF sensor connector(A) and the breather hose(B), remove the air cleaner assembly(C).



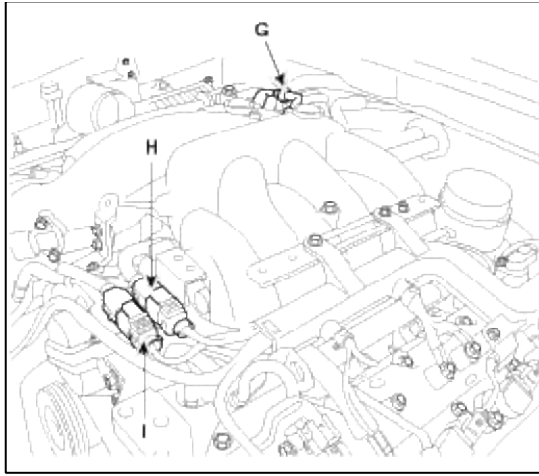
4. Disconnect the other breather hose(A), the Purge Control Solenoid Valve(PCSV) hose, the Positive Crankcase Ventilation (PCV) hose(C) and the Electronic Throttle Control(ETC) cooling hoses(D) and connector(E).



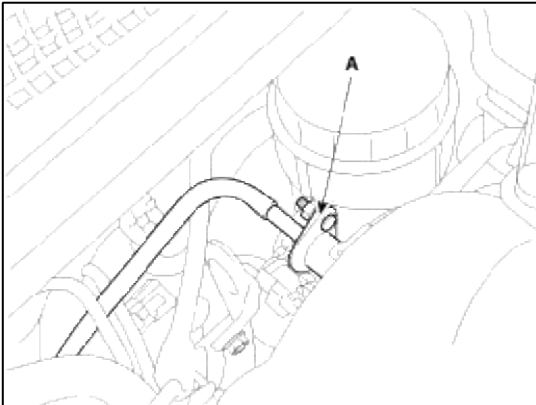
5. Remove the wiring over the surge tank.
- (1) Disconnect the injection harness connector(A).
  - (2) Disconnect the camshaft position sensor(CMP) harness connector(B).
  - (3) Disconnect the ground line(C).
  - (4) Disconnect the ignition coil harness connector(D).
  - (5) Disconnect the condensor connector(E).
  - (6) Disconnect the variable induction system(VIS) solenoid valve connector(G).
  - (7) Disconnect the oil control valve(OCV) harness connector(F).
  - (8) Disconnect the injector wiring(H) and ignition coil wiring(I).



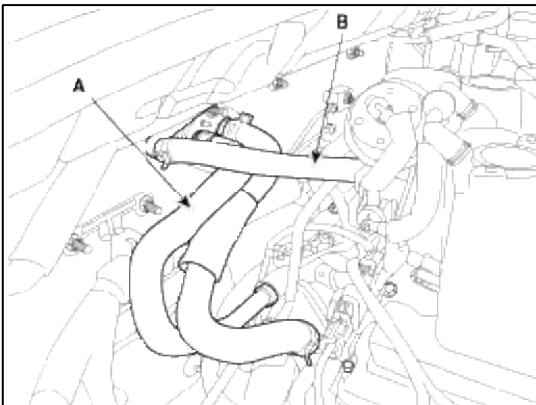




6. Disconnect the fuel hose tube(A).



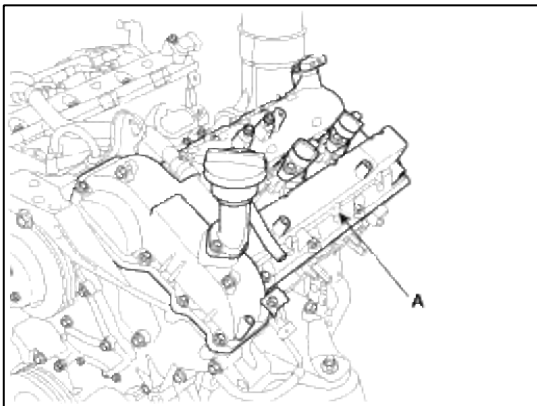
7. Remove heater hose(A) and disconnect the brake vacuum hose(B).



8. Disconnect the surge tank stay.

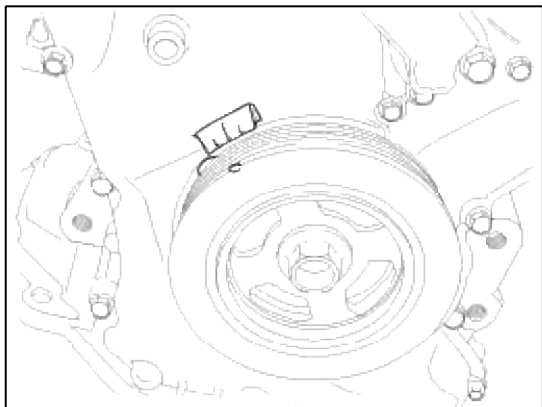
9. Remove the surge tank.

10. Loosen the cylinder head cover bolts and then remove the cover(A) and gasket.



11. Set No.1 cylinder to TDC/compression.

A. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing chain cover.

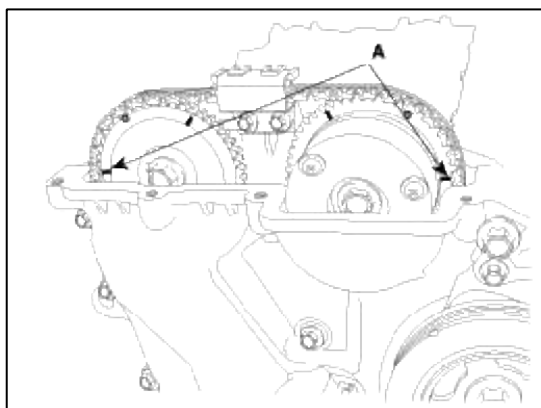


B. Check that the mark(A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration.

If not, turn the crankshaft one revolution (360°)

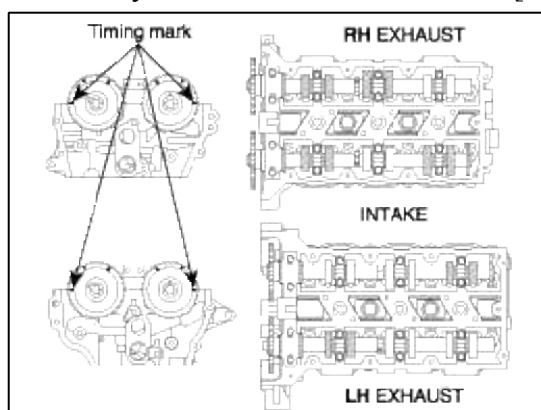
**NOTE**

Do not rotate engine counterclockwise



12. Inspect the valve clearance.

A. Check only the valve indicated as shown. [No. 1 cylinder : TDC/Compression] measure the valve clearance.



- Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.
- Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting tappet.

Valve clearance

Specification

Engine coolant temperature : 20°C [68°F]

Limit

Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)

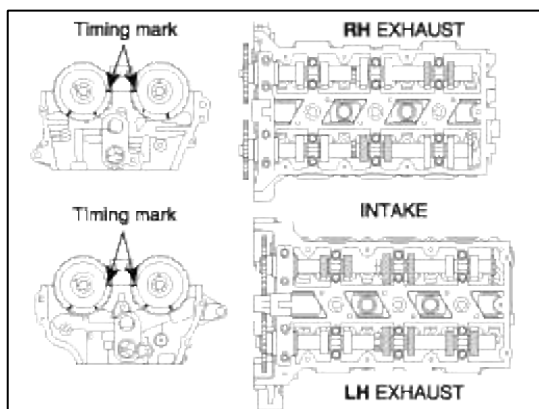
Exhaust : 0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)

- B. Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.

**NOTE**

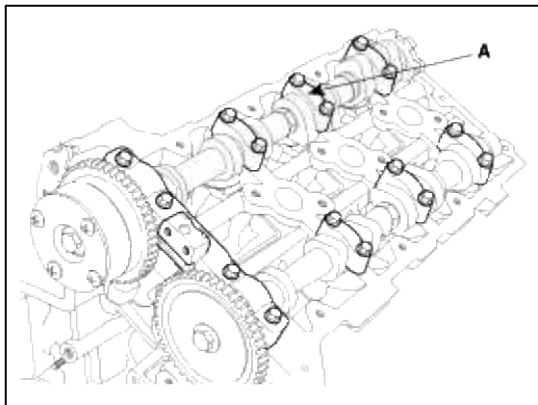
Do not rotate engine counterclockwise

- C. Check only valves indicated as shown. [NO. 4 cylinder : TDC/compression]. Measure the valve clearance.

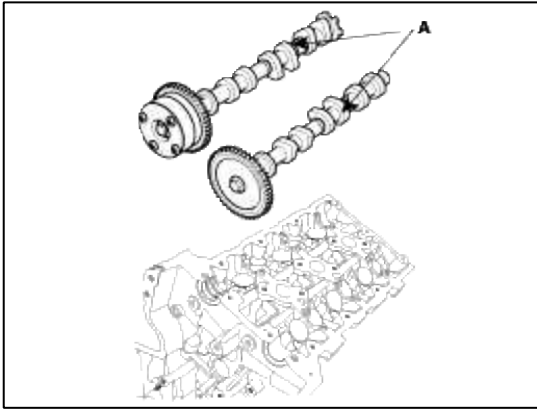


13. Adjust the intake and exhaust valve clearance.

- Set the No.1 cylinder to the TDC/compression.
- Mark on the timing chain on the basis of the marking on sprocket and CVVT.
- Remove the timing chain.
- Remove the camshaft bearing caps(A).

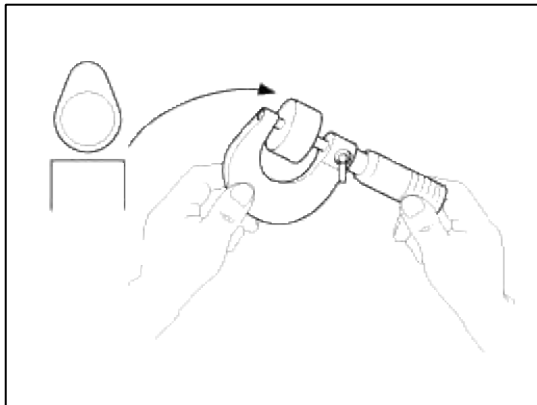


E. Remove the camshaft assembly(A).



F. Remove the tappets.

G. Measure the thickness of the removed tappet using a micrometer.



H. Calculate the thickness of a new tappet so that the valve clearance comes within the specified value.

Valve clearance(Engine coolant temperature: 20°C[68°F])

T : Thickness of removed tappet

A : Measured valve clearance

N : Thickness of new tappet

Intake :  $N = T + [A - 0.20\text{mm}(0.0079\text{in.})]$

Exhaust :  $N = T + [A - 0.30\text{mm}(0.0118\text{in.})]$

I. Select a new tappet with a thickness as close as possible to the calculated value.

**NOTE**

Tappets are available in 41 size increments of 0.015mm (0.0006in.) from 3.00mm (0.118in.) to 3.600mm (0.1417in.)

J. Place a new tappet on the cylinder head.

**NOTE**

Applying engine oil at the selected tappet on the periphery and top surface.

K. Install the intake and exhaust camshaft.

L. Install the bearing caps.

M. Install the timing chain.

N. Turn the crankshaft two turns in the operating direction(clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks.

O. Recheck the valve clearance.

Valve clearance (Engine coolant temperature: 20°C[68°F])

[Specification]

Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)

Exhaust : 0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)

## Engine Mechanical System > General Information > Specifications

### SPECIFICATION

Description			Specifications		Limit
			G6DB - 3.3	G6DA - 3.8	
General					
Type			V-type, DOHC		
Number of cylinders			6		
Bore			92mm (3.6220in)	96mm (3.7795in)	
Stroke			83.8mm (3.2992in)	87.0 mm(3.4252in)	
Total displacement			3,342cc (203.86cu.in)	3.778cc (230.55cu.in)	
Compression ratio			10.4		
Firing order			1-2-3-4-5-6		
Valve timing					
Intake	Opens(ATDC)		14°	10°	
	Closes(ABDC)		66°	66°	
Exhaust	Opens(BBDC)		52°	52°	
	Closes(ATDC)		0°	0°	
Cylinder head					
Flatness of gasket surface			Less than 0.05mm (0.0019in) [Less than 0.02mm (0.0008in) / 150x150]		
Flatness of manifold mounting	Intake		Less than 0.1mm(0.0039in) [Less than 0.03mm(0.001in)/110x110]		
	Exhaust		Less than 0.1mm(0.0039in) [Less than 0.03mm(0.001in)/110x110]		
Camshaft					
Cam height	LH Camshaft	Intake	46.3mm (1.8228in)	46.8mm (1.8425in)	
		Exhaust	45.8mm (1.8031in)		
	RH Camshaft	Intake	46.3mm (1.8228in)	46.8mm(1.8425in)	
		Exhaust	45.8mm (1.8031in)		
Journal outer diameter	LH Camshaft	Intake	No.1: 27.964 ~ 27.978mm (1.1009 ~ 1.1015in)		

Diameter	,RHCamshaft		1.1015in) No.2,3,4: 23.954 ~ 23.970mm (0.9430 ~ 0.9437in)		
		Exhaust	No.1: 27.964 ~ 27.978mm (1.1009 ~ 1.1015in) No.2,3,4: 23.954 ~ 23.970mm (0.9430 ~ 0.9437in)		
Bearing oil clearance	LH ,RHCamshaft	Intake	No.1: 0.027 ~ 0.057mm (0.0011 ~ 0.0022in) No.2,3,4: 0.030 ~ 0.067mm (0.0012 ~ 0.0026in)		
		Exhaust	No.1: 0.027 ~ 0.057mm (0.0011 ~ 0.0022in) No.2,3,4: 0.030 ~ 0.067mm (0.0012 ~ 0.0026in)		
End play			→	0.02 ~ 0.18mm (0.0008 ~ 0.0071in)	

**Valve**

Valve length	Intake	105.27mm(4.1445in)	
	Exhaust	105.50mm (4.1535in)	
Stem outer diameter	Intake	5.465 ~ 5.480mm (0.2151 ~ 0.2157in)	
	Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2153in)	
Face angle		45.25° ~ 45.75°	
Thickness of valvehead(margin)	Intake	1.56 ~ 1.86mm (0.06142 ~ 0.07323in)	
	Exhaust	1.73 ~ 2.03mm (0.06811 ~ 0.07992in)	
Valve stem to valve guide clearance	Intake	0.020 ~ 0.047mm (0.00078 ~ 0.00185in)	0.07mm (0.00275in)
	Exhaust	0.030 ~ 0.054mm (0.00118 ~ 0.00212in)	0.09mm (0.00354in)

**Valve guide**

Inner diameter	Intake	5.500 ~ 5.512mm (0.2165 ~ 0.2170in)	
	Exhaust	5.500 ~ 5.512mm (0.2165 ~ 0.2170in)	
Length	Intake	41.8 ~ 42.2mm (1.6457 ~ 1.6614in)	
	Exhaust	41.8 ~ 42.2mm (1.6457 ~ 1.6614in)	

**Valve seat**

Width of seat contact	Intake	1.15 ~ 1.45mm (0.05118 ~ 0.05709in)	
	Exhaust	1.35 ~ 1.65mm (0.05315 ~ 0.06496in)	
Seat angle	Intake	44.75° ~ 45.20°	
	Exhaust	44.75° ~ 45.20°	

Valve spring				
Free length		43.86mm (1.7267in)		
Load	19.3±0.8kg/34.0mm (42.7±1.8 lb/1.3386in)			
	42.3±1.3kg/24.2mm (93.3±2.9 lb/0.9527in)			
Out of squareness		Less than 1.5°		
MLA				
MLA outer diameter	Intake	34.964 ~ 34.980mm (1.3765 ~ 1.3772in)		
	Exhaust	34.964 ~ 34.980mm (1.3765 ~ 1.3772in)		
Cylinder head tappet bore inner diameter	Intake	35.000 ~ 35.025mm (1.3779 ~ 1.3789in)		
	Exhaust	35.000 ~ 35.025mm (1.3779 ~ 1.3789in)		
MLA to tappet bore clearance	Intake	0.020 ~ 0.061mm (0.0008 ~ 0.0024in)		0.07mm(0.0027in)
	Exhaust	0.020 ~ 0.061mm (0.0008 ~ 0.0024in)		0.07mm(0.0027in)
Valve clearance				
Intake		0.17 ~ 0.23mm (0.0067 ~ 0.0090in)		0.10 ~ 0.30mm (0.0039 ~ 0.0118in)
Exhaust		0.27 ~ 0.33mm (0.0106 ~ 0.0129in)		0.20 ~ 0.40mm (0.0078 ~ 0.0157in)
Cylinder block				
Cylinder bore		92.00 ~ 92.03mm (3.6220 ~ 3.6232in)	96.00 ~ 96.03mm (3.7795 ~ 3.7807in)	
Flatness of gasket surface		Less than 0.05mm (0.0019in) [Less than 0.02mm (0.0008in) / 150x150]		
Piston				
Piston outer diameter		91.96 ~ 92.00mm (3.6205 ~ 3.6220in)	95.96 ~ 95.99mm (3.7779 ~ 3.7791in)	
Piston to cylinder clearance		→	0.03 ~ 0.05mm (0.0012 ~ 0.0020in)	
Ring groove width	No. 1 ring groove	→	1.22 ~ 1.24 (0.0480 ~ 0.0488in)	1.26mm (0.0496in)
	No. 2 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in)		1.26mm (0.0496in)
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in)		2.05mm (0.0807in)
Piston ring				
Side clearance	No. 1 ring	→	0.03 ~ 0.07mm (0.0012 ~ 0.0027in)	0.1mm (0.004in)

	No. 2 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0027in)	0.1mm (0.004in)
	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in)	0.2mm (0.008in)
End gap	No. 1 ring	0.17 ~ 0.32mm (0.0067 ~ 0.0126in)	0.6mm (0.0236in)
	No. 2 ring	0.32 ~ 0.47mm (0.0126 ~ 0.0185in)	0.7mm (0.0275in)
	Oil ring	0.20 ~ 0.70mm (0.0078 ~ 0.0275in)	0.8mm (0.0315in)
<b>Piston pin</b>			
Piston pin outer diameter	→	23.001 ~ 23.006mm (0.9055 ~ 0.9057in)	
Piston pin hole inner diameter	→	23.016 ~ 23.021mm (0.9061 ~ 0.9063in)	
Piston pin hole clearance	→	0.01 ~ 0.02mm(0.0039 ~ 0.0078in)	
Connecting rod small end inner diameter		22.974 ~ 22.985mm (0.9045 ~ 0.9049in)	
<b>Connecting rod</b>			
Connecting rod big end innerdiameter		58.000 ~ 58.018mm(2.2834 ~2.2842in)	
Connecting rod bearing oil clearance	→	0.038 ~ 0.056mm (0.0015 ~ 0.0022in)	
Side clearance		0.1 ~ 0.25mm (0.0039 ~ 0.0098in)	
<b>Crankshaft</b>			
Main journal outer diameter		68.942 ~ 68.960mm (2.7142 ~ 2.7149in)	
Pin journal outer diameter		54.954 ~ 54.972mm (2.1635 ~ 2.1642in)	
Main bearing oil clearance		0.022 ~ 0.040mm (0.0008 ~ 0.0016in)	
End play		0.10 ~ 0.28mm (0.0039 ~ 0.0110in)	
<b>Oil pump</b>			
Relief valve opening pressure		450 ~ 550kPa (4.59 ~ 5.61kgf/cm <sup>2</sup> , 65.28 ~ 79.79psi)	
<b>Engine oil</b>			
Oil quantity (Oil pan)		4.5 ~ 5.5L(4.76 ~ 5.81U.S.qus, 3.96 ~ 4.84Imp.qts)	
Oil quantity (Oil filter)		0.4L(0.42U.S.qus, 0.35Imp.qts)	
Oil quantity (Drain and refill)		5.2L(5.49U.S.qus, 4.58Imp.qts)	
Oil quality		Above SJ or SL	
Oil pressure		130kPa(1.32kgf/cm <sup>2</sup> , 18.77psi) [at 1000rpm, 110°C(230°F)]	
<b>Cooling system</b>			
Cooling method		Forced circulation with electrical fan	
Coolant quantity		9.0L(9.40U.S.qus, 7.83Imp.qts)	
Thermostat	Type	Wax pellet type	



	Opening temperature	82±2°C (179.6±35.6°F)	
	Fully opened temperature	95°C (203°F)	
	Full lift	more than 10mm (0.3937in)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm <sup>2</sup> , 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05kg/cm <sup>2</sup> , 0.14 ~ 0.71 psi)	
<b>Water temperature sensor</b>			
Type		Thermister type	
Resistance	20°C (68°F)	2.31 ~ 2.59kΩ	
	80°C(176°F)	0.3222 kΩ	

## TIGHTENING TORQUE

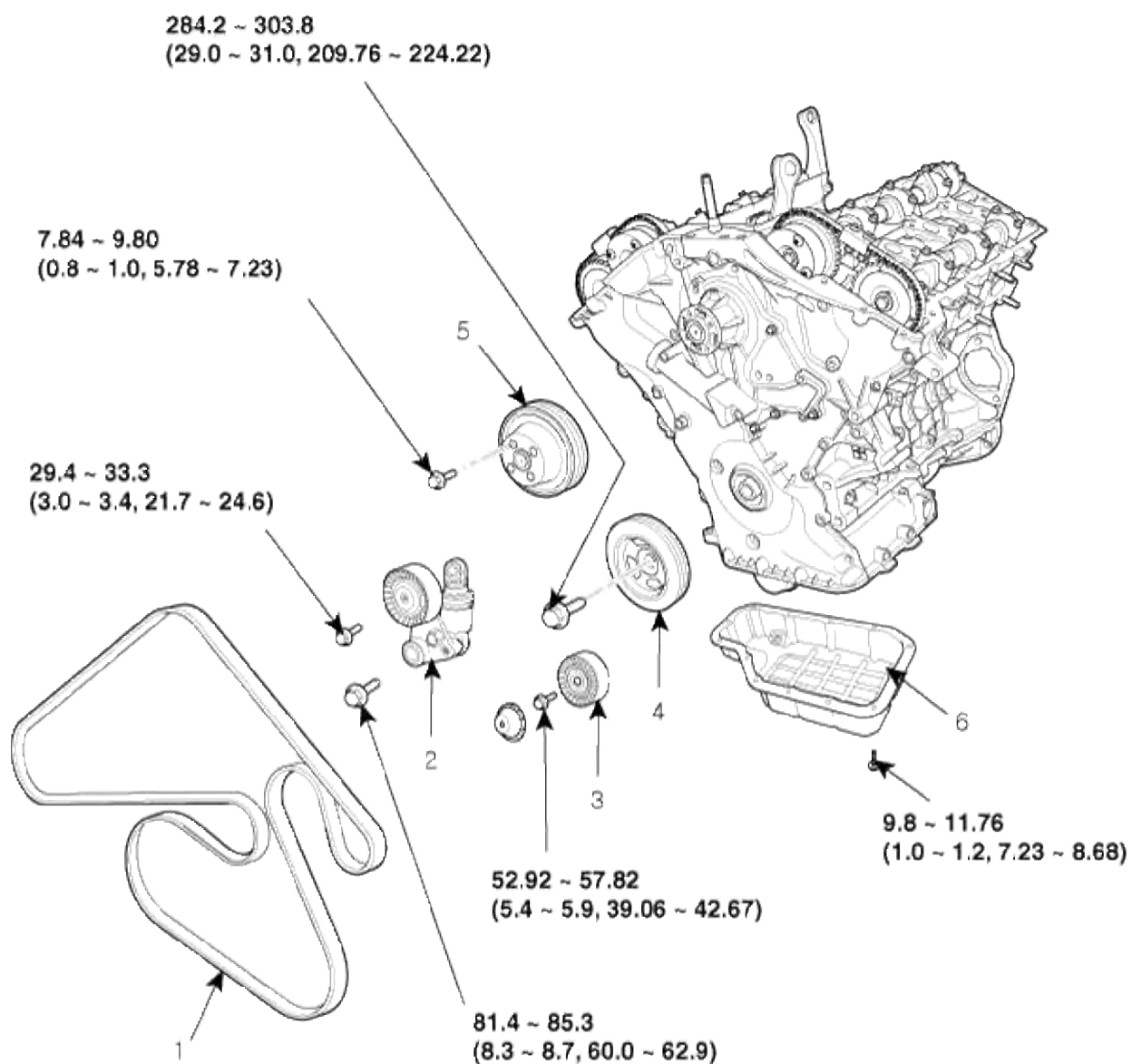
Item	Quantity	Nm	kgf.m	lb.ft
Crankshaft pulley bolt	1	284.2 ~ 303.8	29.0 ~ 31.0	209.76 ~ 224.22
Timing chain cover bolt B	17	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Timing chain cover bolt C	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt D	1	58.80 ~ 68.80	6.0 ~ 7.0	43.40 ~ 50.63
Timing chain cover bolt E	1	58.80 ~ 68.80	6.0 ~ 7.0	43.40 ~ 50.63
Timing chain cover bolt F	2	24.50 ~ 26.46	2.5 ~ 2.7	18.08 ~ 19.53
Timing chain cover bolt G	4	21.56 ~ 23.52	2.2 ~ 2.4	15.91 ~ 17.36
Timing chain cover bolt H	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt I	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt J	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Cam to cam guide bolt	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain auto tensioner bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain auto tensioner nut	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain guide bolt	4	19.60 ~ 24.50	2.0 ~ 2.5	14.17 ~ 18.08
Oil pump chain cover bolt	3	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain tensioner bolt	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain guide bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain sprocket bolt	1	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Lower oil pan bolt	13	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Drive belt auto tensioner bolt(M12)	1	81.4 ~ 85.3	8.3 ~ 8.7	60.0 ~ 62.9
Drive belt auto tensioner bolt(M8)	1	29.4 ~ 33.3	3.0 ~ 3.4	21.7 ~ 24.6
Drive belt idler bolt	1	53.90 ~ 57.82	5.5 ~ 5.9	39.78 ~ 42.67
OCV(oil control valve) bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68

Cylinder head bolt	16	(37.3~41.2) + (118~122°) + (88~92°)	(3.8~4.2) + (118~122°) + (88~92°)	(27.5~30.4) + (118~122°) + (88~92°)
Cylinder head bolt	1	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
CVVT & exhaust cam sprocket bolt	4	64.68 ~ 76.44	6.6 ~ 7.8	47.74 ~ 56.42
Camshaft bearing cap bolt	32	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Cylinder head cover bolt	38	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Connecting rod bearing bolt	12	(17.7~21.6) + (88~92°)	(1.8~2.2) + (88~92°)	(13.0~15.9) + (88~92°)
Main bearing cap inner bolt(M11)	8	49.00 + 90°	5.0 + 90°	36.16 + 90°
Main bearing cap outer bolt(M8)	8	19.60 + 120°	2.0 + 120°	14.46 + 120°
Main bearing cap side bolt(M8)	6	29.40 ~ 31.36	3.0 ~ 3.2	21.70 ~ 23.14
Oil drain cover bolt	6	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Rear oil seal case bolt	6	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Baffle plate bolt	12	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Upper oil pan bolt	16	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Knock sensor bolt	2	15.68 ~ 23.52	1.6 ~ 2.4	11.57 ~ 17.36
Drive plate bolt	8	71.54 ~ 75.46	7.3 ~ 7.7	52.80 ~ 55.69
Oil filter cap	1	24.50	2.5	18.08
Oil drain bolt	1	34.30 ~ 44.10	3.5 ~ 4.5	25.31 ~ 32.55
Oil pump bolt	3	19.60 ~ 23.52	2.0 ~ 2.4	14.47 ~ 17.36
Oil filter body bolt	10	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil filter body cover bolt	11	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water vent hose bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump bolt(Timing chain cover bolt L)	1	21.56 ~ 26.46	2.2 ~ 2.7	15.91 ~ 19.53
Water pump bolt(Timing chain cover bolt K)	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump pulley bolt	4	7.84 ~ 9.80	0.8 ~ 1.0	5.78 ~ 7.23
Water temp. control nut	4	19.6 ~ 23.52	2.0 ~ 2.4	14.5 ~ 17.36
Water temp. control bolt	2	19.6 ~ 23.52	2.0 ~ 2.4	14.5 ~ 17.36
Water inlet pipe bolt	3	16.66 ~ 19.60	1.7 ~ 2.0	12.30 ~ 14.47
Air vent pipe bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Intake manifold bolt	6	26.5 ~ 31.4	2.7 ~ 3.2	19.5 ~ 23.1
Intake manifold nut	2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Surge tank bolt	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank nut	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold stay bolt	4	52.0 ~ 56.9	5.3 ~ 5.8	38.3 ~ 42.0
Surge tank bolt	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4

Breather pipe bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank bracket bolt	2	27.44 ~ 31.36	2.8 ~ 3.2	20.25 ~ 23.14
ETC bracket bolt	2	15.68 ~ 25.48	1.6 ~ 2.6	11.57 ~ 18.80
Exhaust manifold nut	16	39.20 ~ 44.10	4.0 ~ 4.5	28.93 ~ 32.55
Heat protector bolt	6	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Front muffler	2	39.20 ~ 58.80	4.0 ~ 6.0	28.93 ~ 43.40

## Engine Mechanical System > Timing System > Timing Chain > Components and Components Location

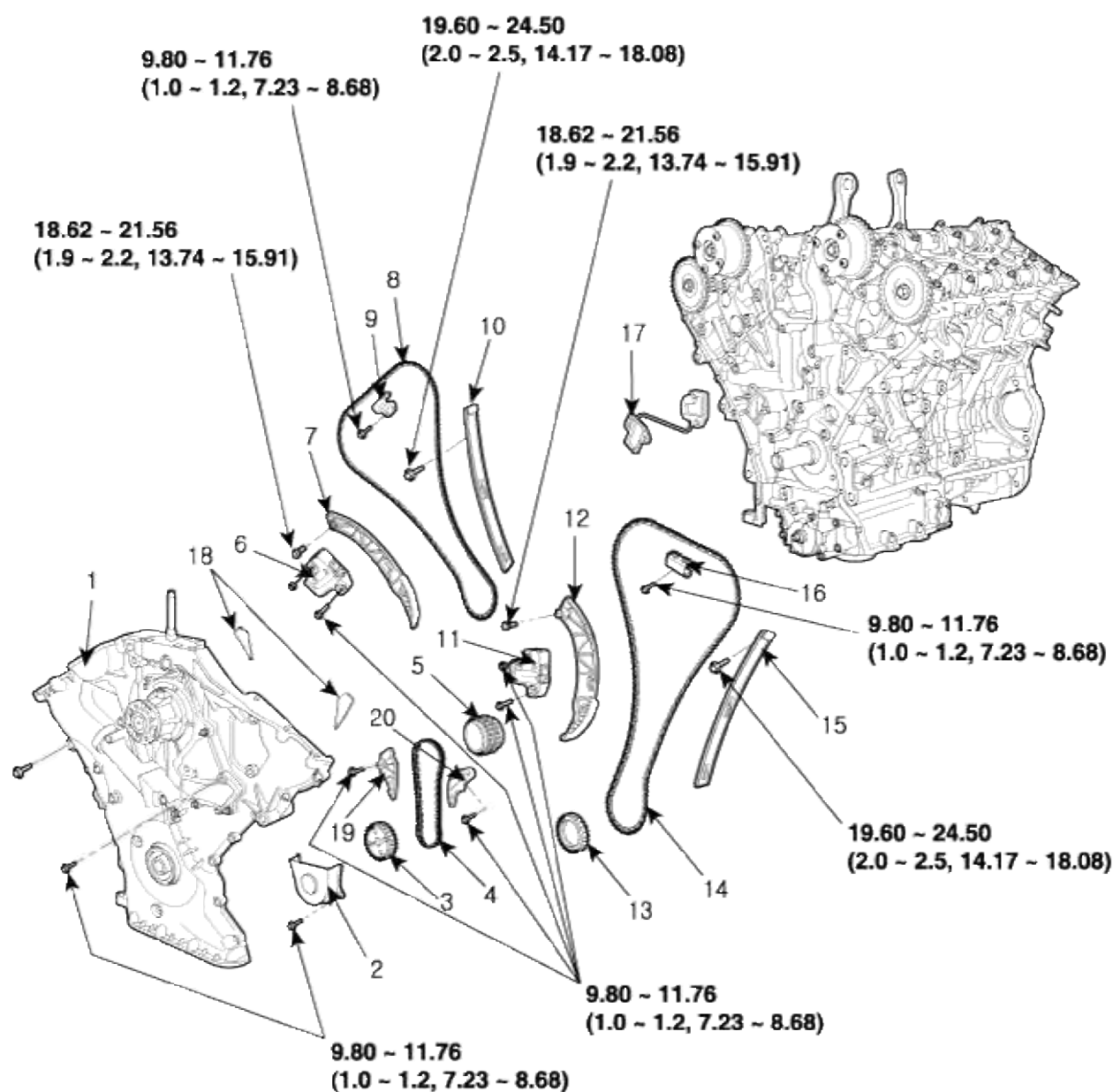
### COMPONENTS



**TORQUE : N.m (kgf.m, lbf.ft)**

1. Drive belt
2. Drive belt tensioner
3. Idler
4. Damper pulley

5. Water pump pulley
6. Oil pan

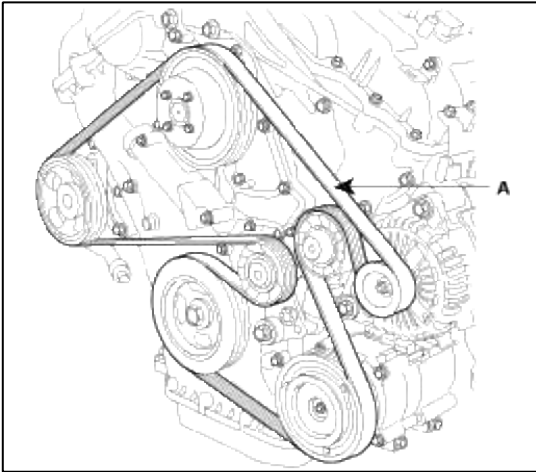

**TORQUE : N.m (kgf.m, lbf.ft)**

1. Timing chain cover	8. Timing chain	15. Timing chain guide
2. Oil pump chain cover	9. Cam to cam guide	16. Cam to cam guide
3. Oil pump sprocket	10. Timing chain guide	17. Tensioner adapter
4. Oil pump chain	11. Timing chain auto tensioner	18. Gasket
5. Crankshaft sprocket	12. Timing chain tensioner arm	19. Oil pump chain guide
6. Timing chain auto tensioner	13. Crankshaft sprocket	20. Oil pump tensioner assembly
7. Timing chain tensioner arm	14. Timing chain	

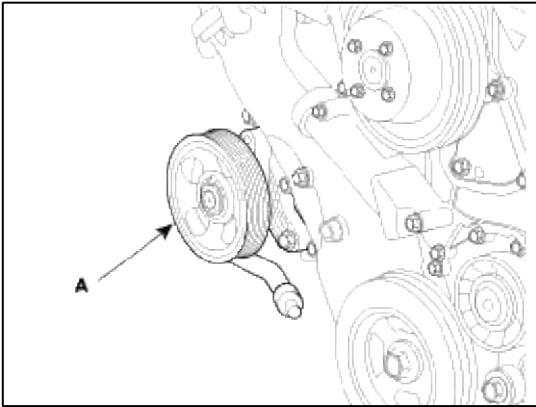
**Engine Mechanical System > Timing System > Timing Chain > Repair procedures**
**REMOVAL**

Radiator removal is required for this procedure. (Refer to 'Radiator removal')

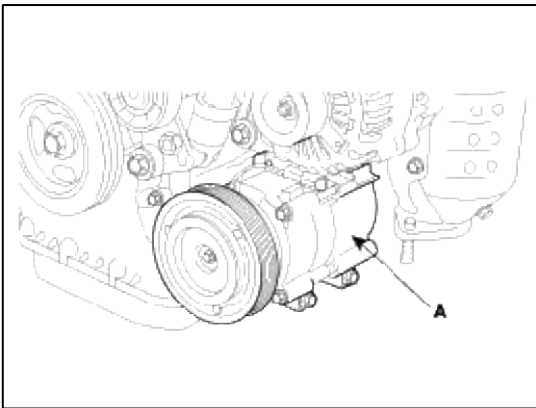
1. Remove the drive belt(A).



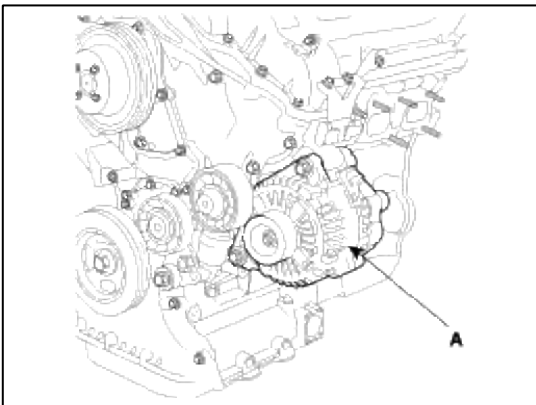
2. Remove the power steering pump(A).



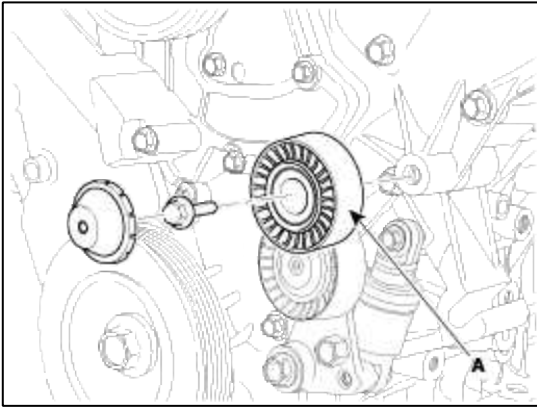
3. Remove the air compressor(A).



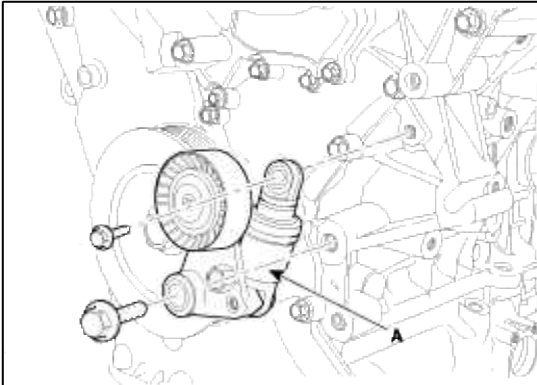
4. Remove the alternator(A).



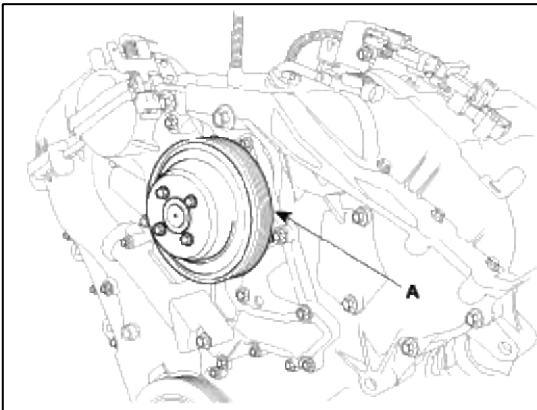
5. Remove drive belt idler(A).



6. Remove drive belt auto tensioner(A).



7. Remove water pump pulley(A).



8. Remove intake manifold.

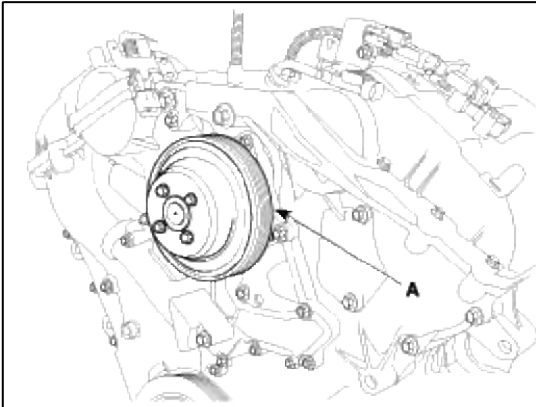
## INSTALLATION

1. Install intake manifold.

2. Install water pump pulley(A).

**Tightening torque**

7.84 ~ 9.80Nm(0.8 ~ 1.0kgf.m, 5.78 ~ 7.23lb-ft)

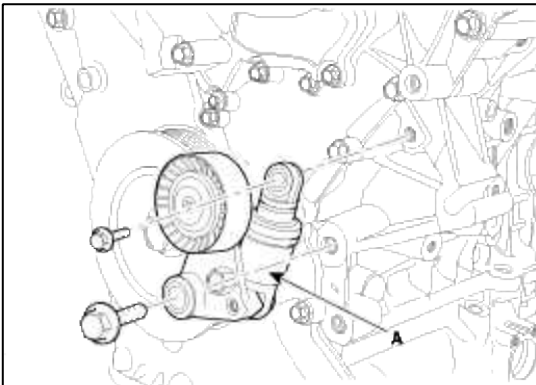


3. Install drive belt auto tensioner(A).

**Tightening torque**

81.4 ~ 85.3Nm(8.3 ~ 8.7kgf.m, 60.0 ~ 62.9lb-ft)

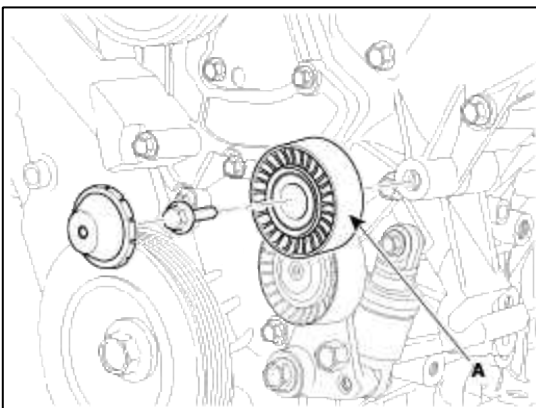
29.4 ~ 33.3Nm(3.0 ~ 3.4kgf.m, 21.7 ~ 24.6lb-ft)



4. Install drive belt idler(A).

**Tightening torque**

52.92 ~ 57.82Nm(5.4 ~ 5.9kgf.m, 39.06 ~ 42.67lb-ft)



5. Install alternator

6. Install air compressor

7. Install power steering pump.

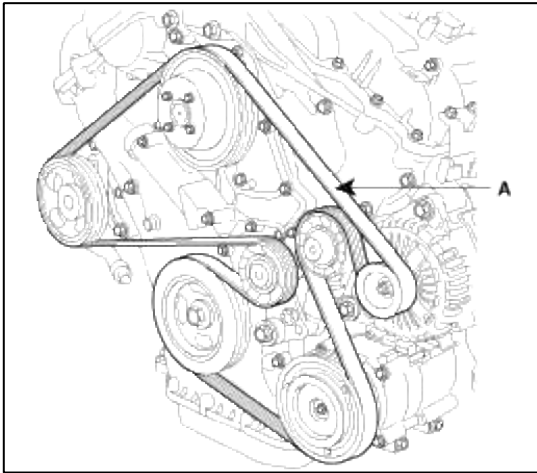


## 8. Install drive belt(A).

Crankshaft pulley → A/C pulley → idler pulley → alternator pulley → water pump pulley → P/S pump pulley → tensioner pulley.

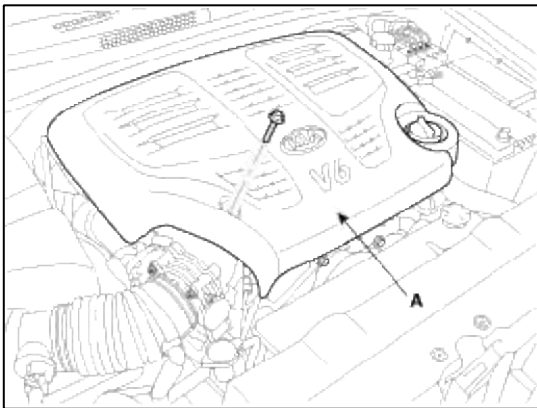
Rotate auto tensioner arm in the counter - clockwise moving auto tensioner pulley bolt with wrench.

After putting belt on auto tensioner pulley, release the auto tensioner pulley slowly.

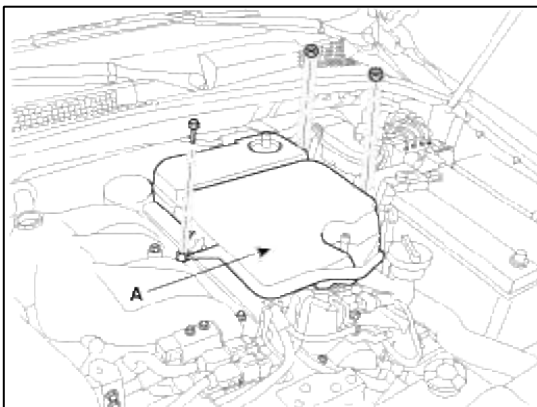


## DISASSEMBLY

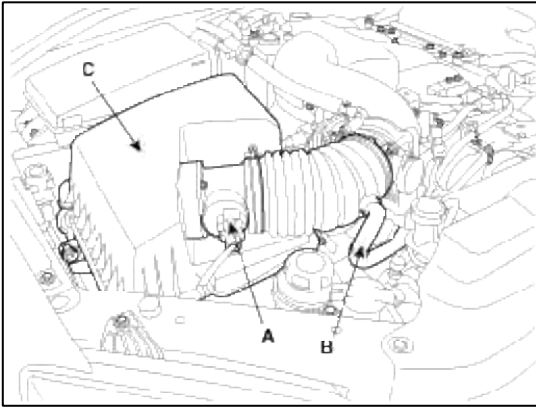
## 1. Remove the engine cover.



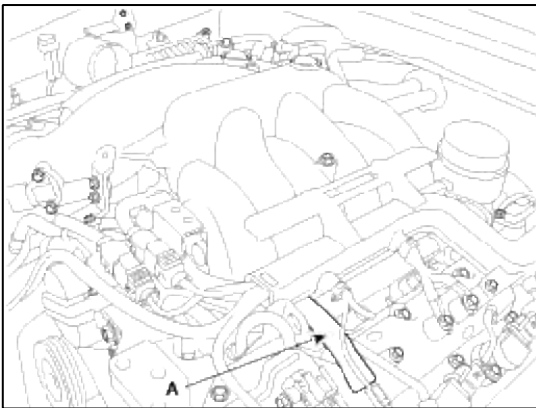
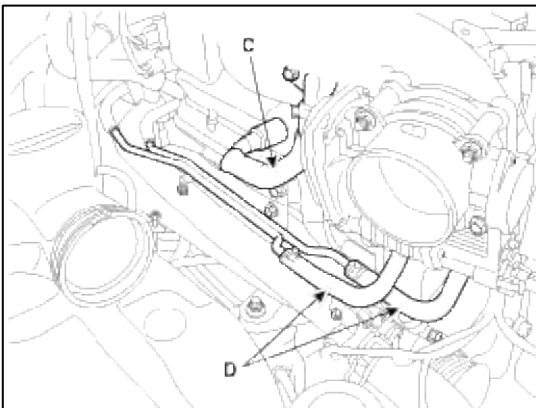
## 2. Remove the engine room resonator(A).



3. After disconnecting the MAF sensor connector(A) and the breather hose(B), remove the air cleaner assembly(C).

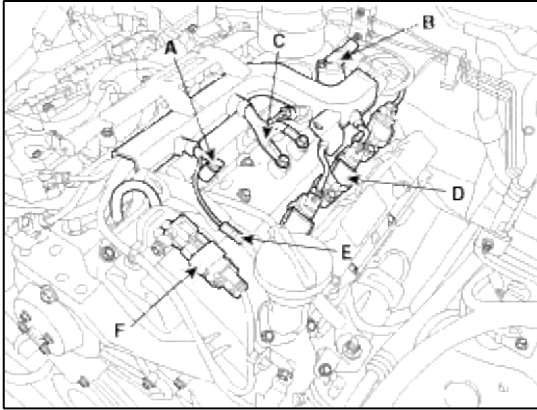


4. After disconnecting the other breather hose(A), the Purge Control Solenoid Valve(PCS) hose(B), the Positive Crankcase Ventilation (PCV) hose(C) and the Electronic Throttle Control(ETC) cooling hoses(D), remove the surge tank assembly(E).

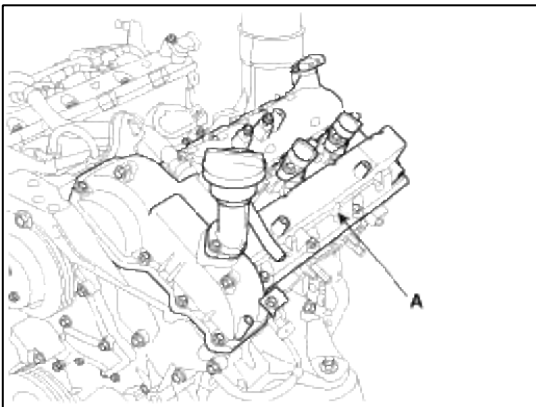


## 5. Remove the wiring over the surge tank.

- (1) Disconnect the injection harness connector(A).
- (2) Disconnect the camshaft position sensor(CMP) harness connector(B).
- (3) Disconnect the ground lines(C).
- (4) Disconnect the ignition coil harness connector(D).
- (5) Disconnect the condensor connector(E).
- (6) Disconnect the oil control valve(OCV) harness connector(F).



## 6. Loosen the cylinder head cover bolts and then remove the cover(A) and gasket.

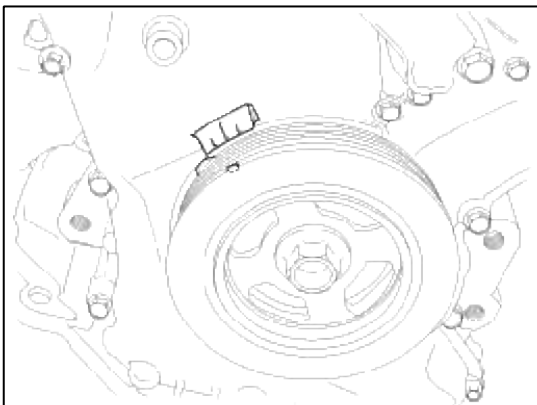


## 7. Set No.1 cylinder to TDC/compression.

- A. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing chain cover.

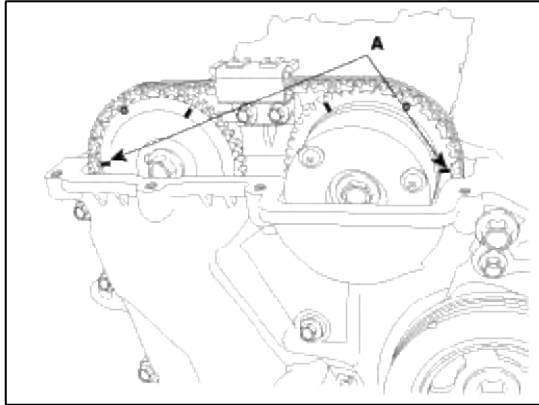
**NOTE**

Do not rotate engine counterclockwise.



B. Check that the mark(A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration.

If not, turn the crankshaft one revolution (360°).

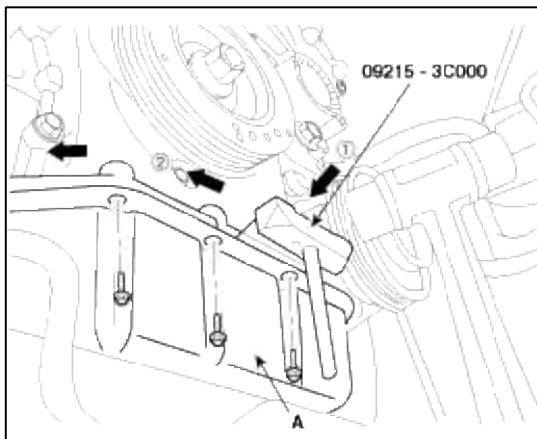


#### NOTE

Do not rotate engine counterclockwise.

8. Remove the lower oil pan(A).

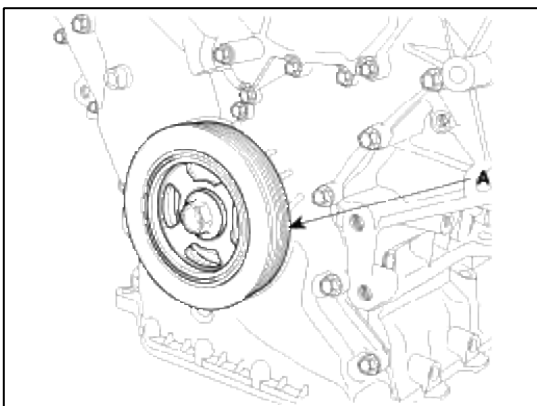
Insert the blade of SST(09215-3C000) between the upper oil pan and lower oil pan, and cut off applied sealer and removed lower oil pan.



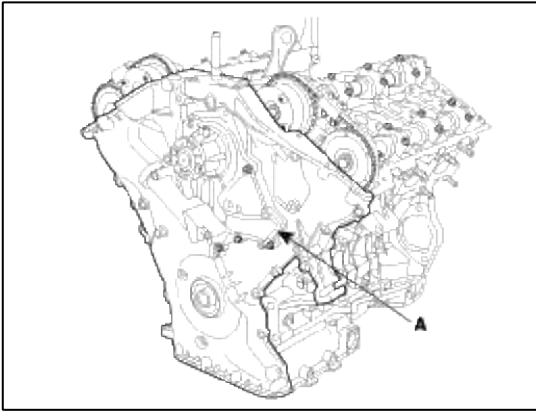
#### CAUTION

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It can result in damage of the SST.

9. Remove the crankshaft damper pulley(A).



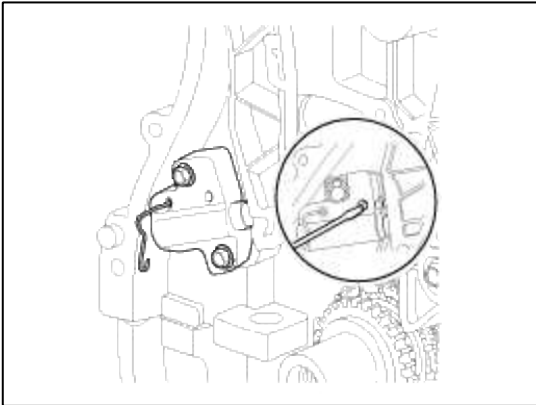
10. Remove the timing chain cover(A).



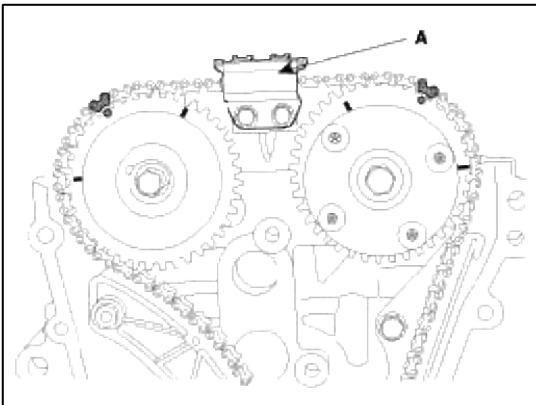
**NOTE**

- Be careful not to damage the contact surfaces of cylinder block, cylinder head and timing chain cover.
- Mark on the timing chain on the basis of the marking on sprocket and CVVT.

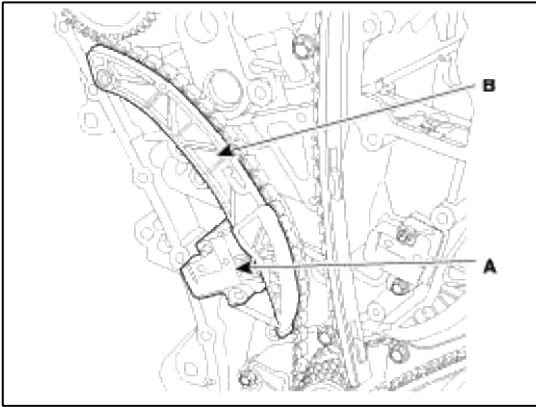
11. Install a set pin after compressing the timing chain tensioner.



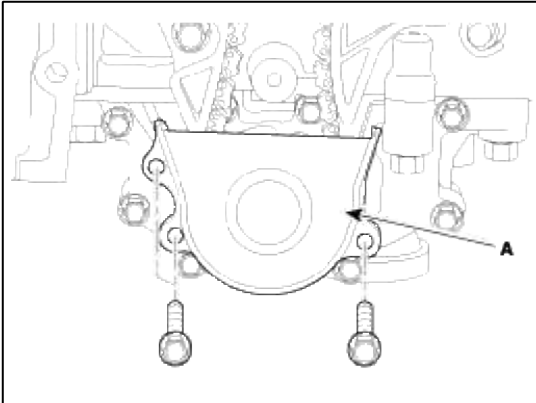
12. Remove RH cam-to-cam guide(A).



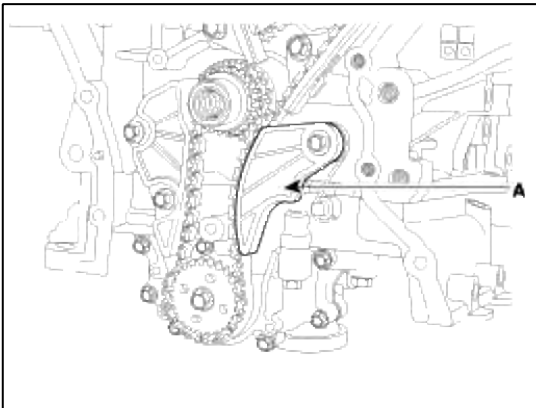
13. Remove RH timing chain auto tensioner(A) and RH timing chain tensioner arm(B).



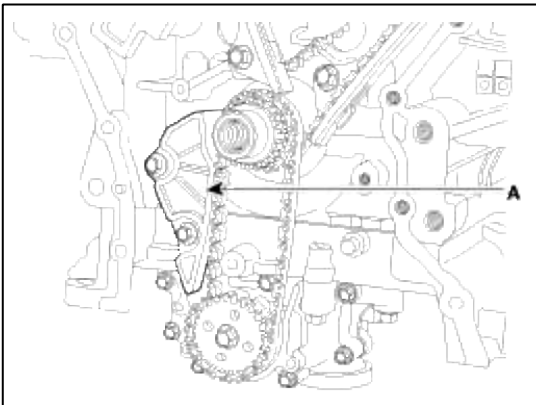
14. Remove oil pump chain cover(A).



15. Remove oil pump chain tensioner assembly(A).

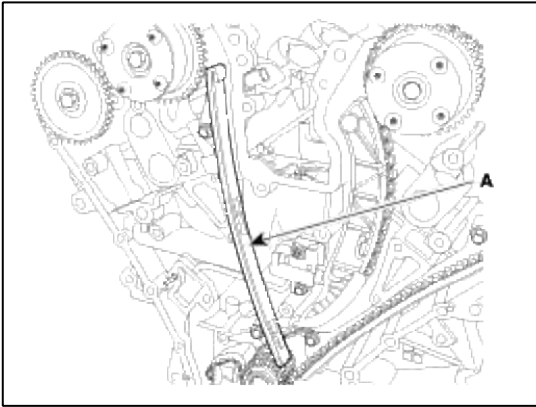


16. Remove oil pump chain guide(A).

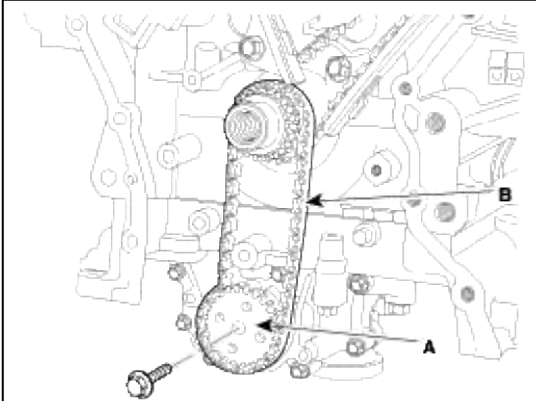


17. Remove RH timing chain.

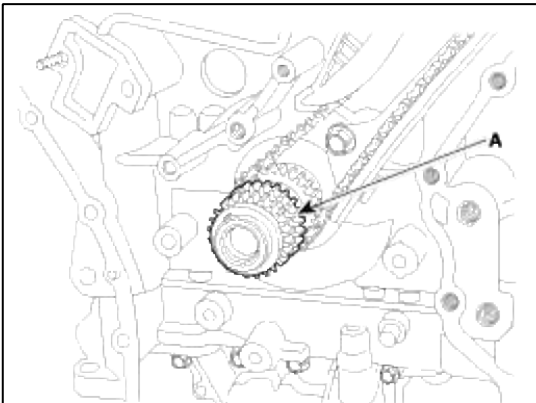
18. Remove RH timing chain guide(A).



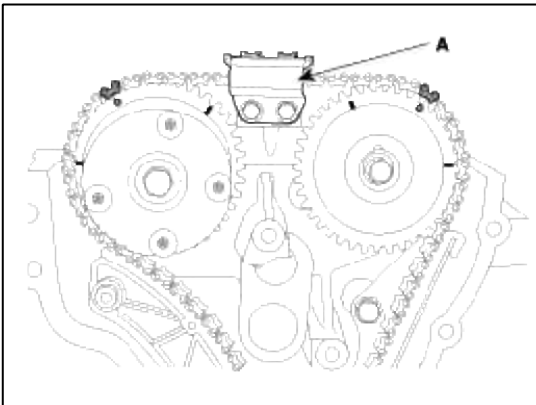
19. Remove oil pump chain sprocket(A) and oil pump chain(B).



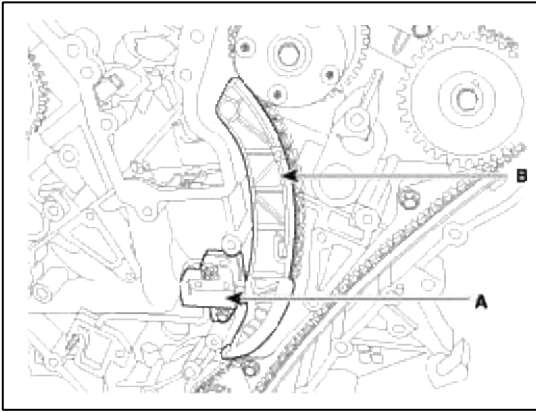
20. Remove crankshaft sprocket(A)(O/P & RH camshaft drive).



21. Remove LH cam-to-cam guide(A).

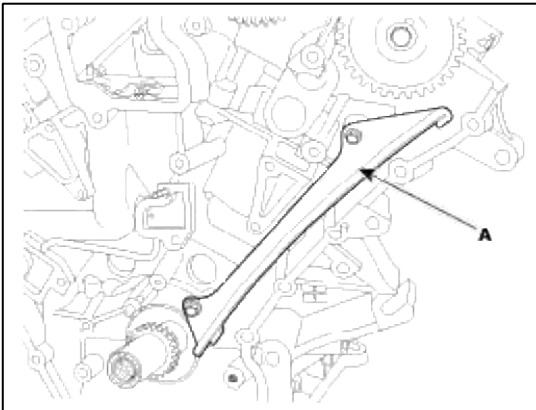


22. Remove LH timing chain auto tensioner(A) and LH timing chain tensioner arm(B).

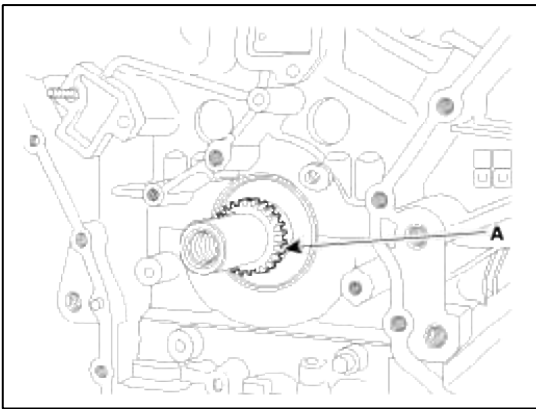


23. Remove LH timing chain.

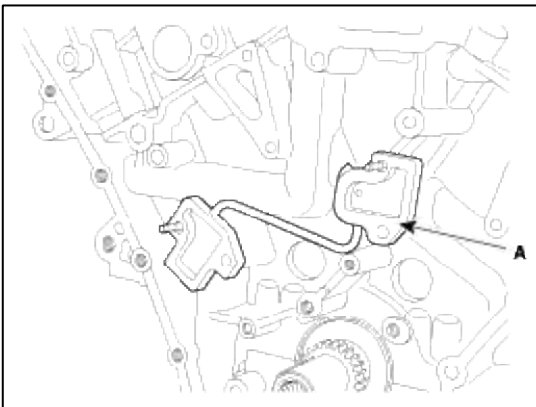
24. Remove LH timing chain guide(A).



25. Remove crankshaft sprocket(A)(LH camshaft drive).



26. Remove tensioner adapter assembly(A).



## INSPECTION

### SPROCKETS, CHAIN TENSIONER, CHAIN GUIDE, CHAIN TENSIONER ARM



1. Check the camshaft sprocket and crankshaft sprocket for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner arm and chain guide for abnormal wear, cracks, or damage. Replace as necessary.
3. Check that the tensioner piston moves smoothly when the ratchet pawl is released with thin rod.

#### BELT, IDLER, BELT TENSIONER, PULLEY

1. Check the belt for oil or dust deposits.

Replace, if necessary.

Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.

2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt.

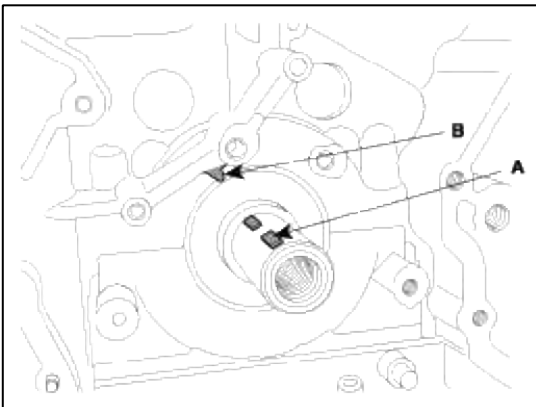
#### NOTE

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water and steam.

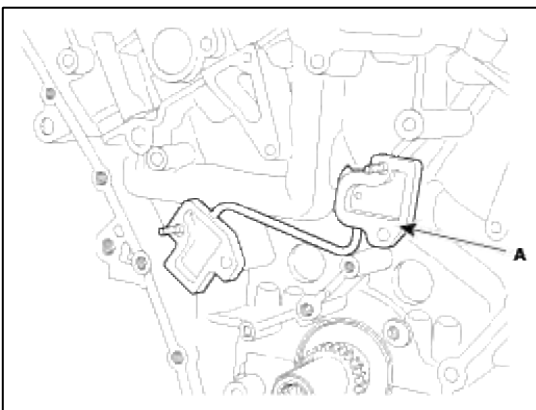
3. Inspect the idler for easy and smooth rotation and check for play or noise.

#### REASSEMBLY

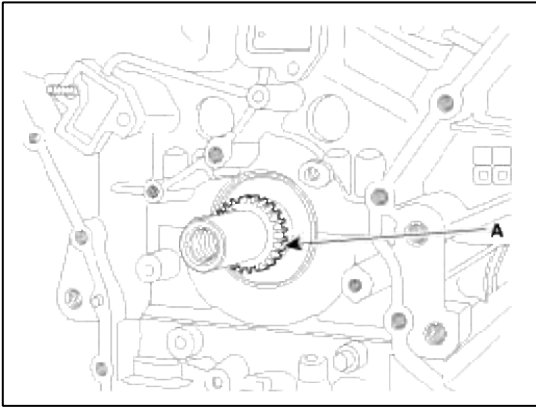
1. The key(A) of crankshaft should be aligned with the timing mark(B) of timing chain cover. As a result of this, the piston of No.1 cylinder is placed at the top dead center on compression stroke.



2. Install tensioner adapter assembly(A).



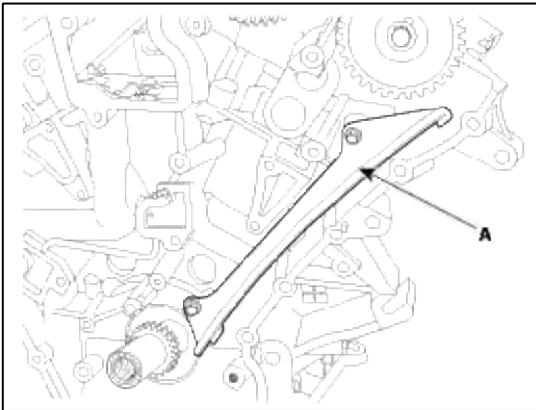
3. Install crankshaft sprocket(A)(LH camshaft drive).



4. Install LH timing chain guide(A).

**Tightening torque**

19.60 ~ 24.50Nm(2.0 ~ 2.5kgf.m, 14.17 ~ 18.08lb-ft)

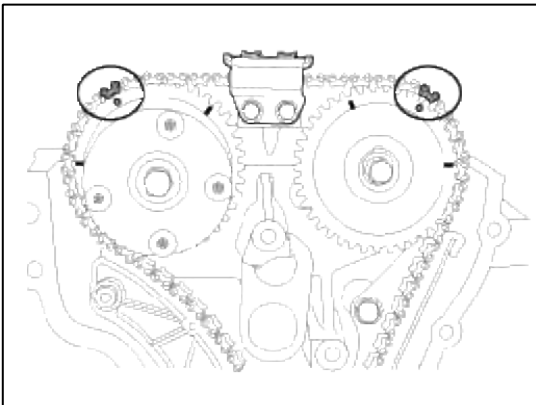


5. Install LH timing chain.

To install the timing chain with no slack between each shaft (cam, crank), follow the below procedure.

Crankshaft sprocket(A) → Timing chain guide(B) → Exhaust camshaft sprocket(C) → Intake camshaft sprocket(D).

The timing mark of each sprockets should be matched with timing mark (color link) of timing chain at installing timing chain.



6. Install LH timing chain tensioner arm(B).

**Tightening torque**

18.62 ~ 21.56Nm(1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lb-ft)

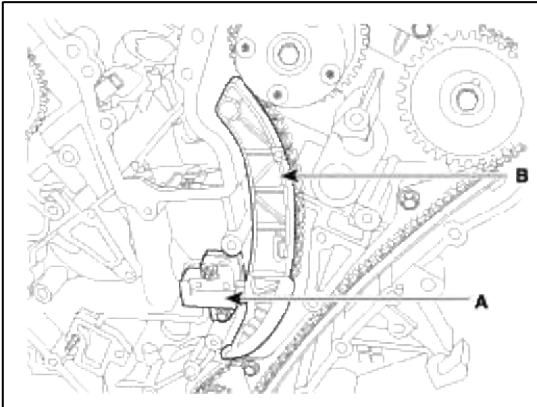
7. Install chain tensioner(A).

---

**Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

---



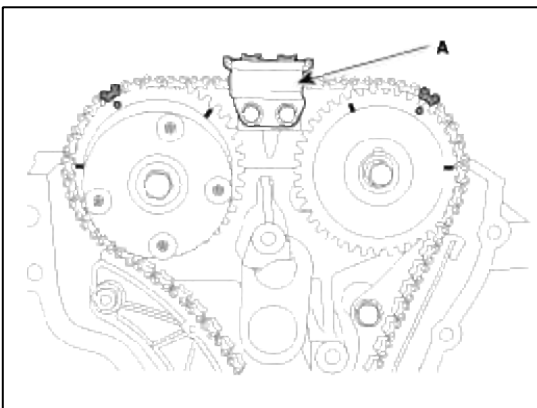
8. Install LH cam-to-cam guide(A).

---

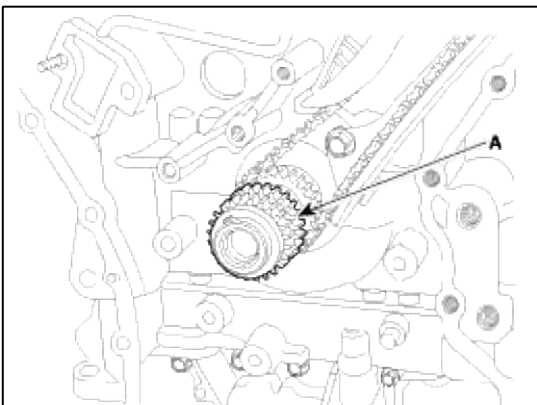
**Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

---



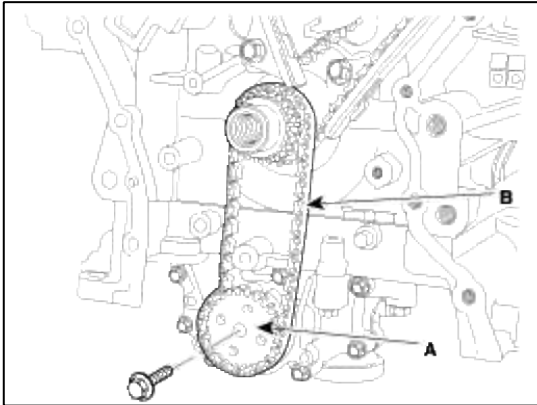
9. Install crankshaft sprocket(A)(O/P & RH camshaft drive).



10. Install oil pump chain(B) and oil pump sprocket(A).

**Tightening torque**

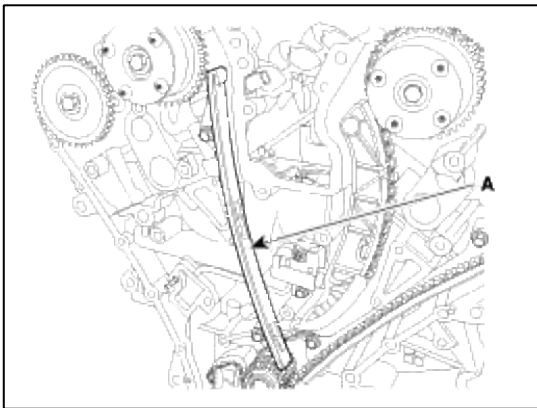
18.62 ~ 21.56Nm(1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lb-ft)



11. Install RH timing chain guide(A).

**Tightening torque**

19.60 ~ 24.50Nm(2.0 ~ 2.5kgf.m, 14.17 ~ 18.08lb-ft)

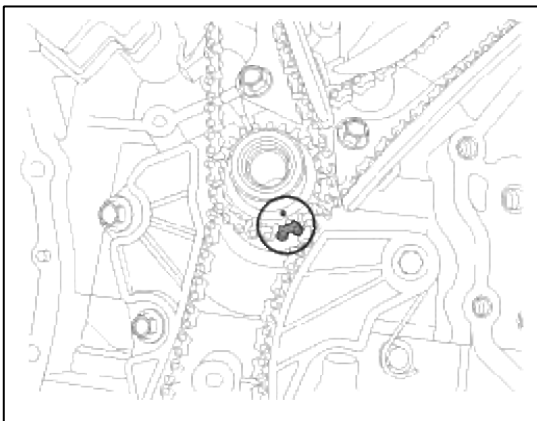


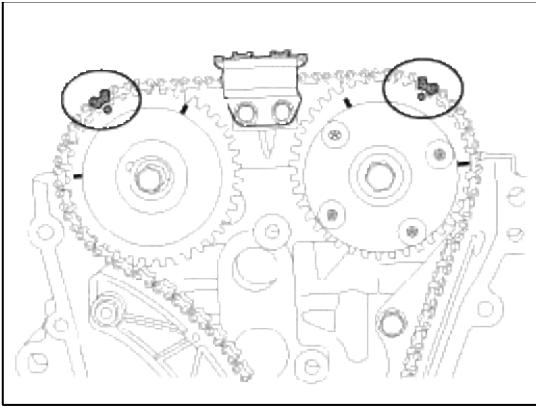
12. Install RH timing chain.

To install the timing chain with no slack between each shaft (cam, crank), follow the below procedure.

Crankshaft sprocket(A) → Intake camshaft sprocket(B) → Exhaust camshaft sprocket(C).

The timing mark of each sprockets should be matched with timing mark (color link) of timing chain at installing timing chain.





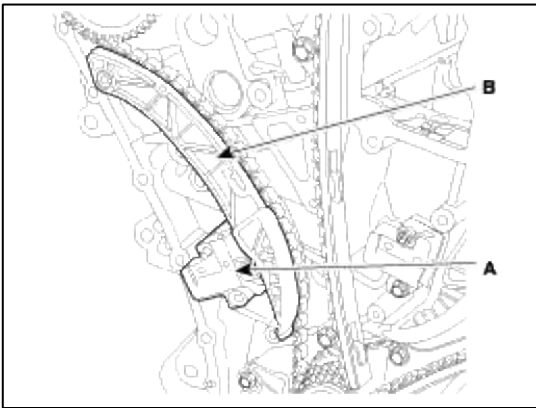
13. Install RH timing chain tensioner arm(B).
14. Install RH timing chain auto tensioner(A).

---

#### **Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

---



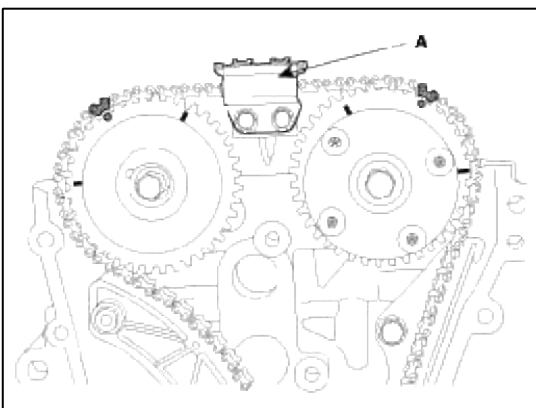
15. Install RH cam-to-cam guide(A).

---

#### **Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

---



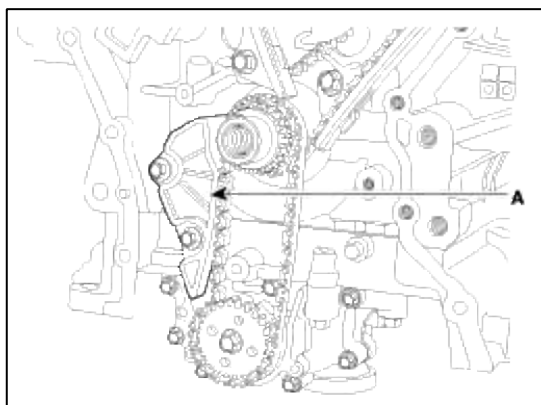
16. Install oil pump chain guide(A).

---

**Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

---



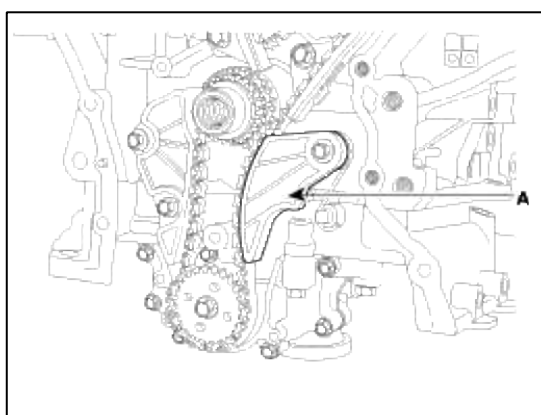
17. Install oil pump chain tensioner assembly(A).

---

**Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

---



18. Pull out the pins of hydraulic tensioner (LH & RH).

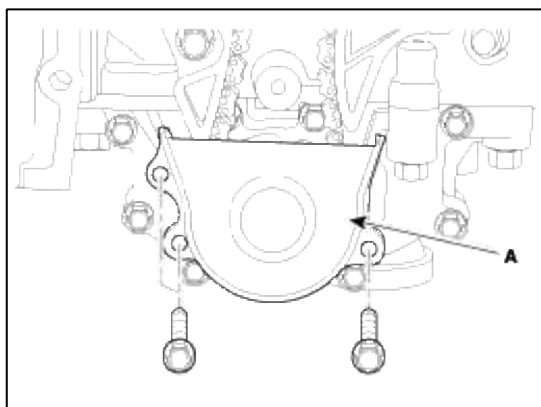
19. Install oil pump chain cover(A).

---

**Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

---



20. After rotating crankshaft 2 revolutions in regular direction(clockwise viewed from front), confirm the timing mark.

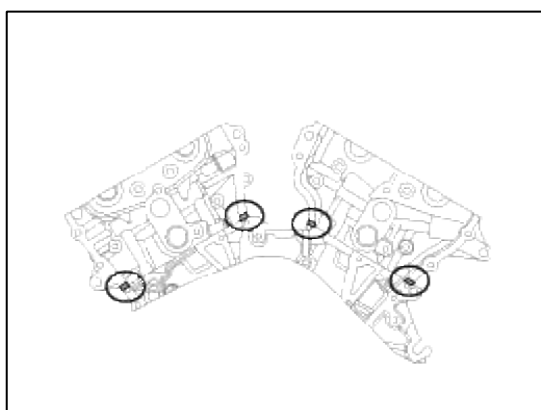
**NOTE**

Always turn the crankshaft clockwise.

21. Install timing chain cover.

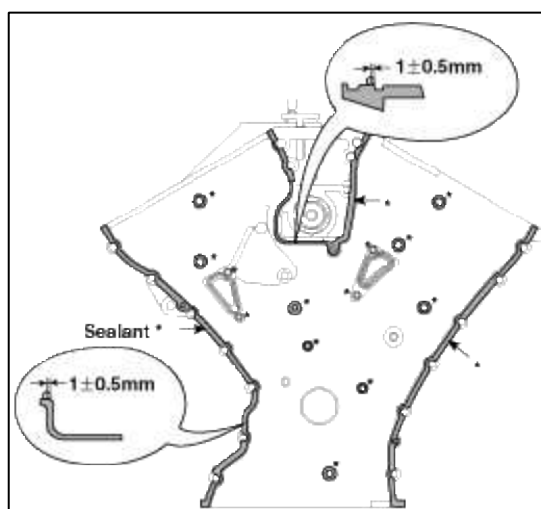
- A. The sealant locations on chain cover and on counter parts (cylinder head, cylinder block, and lower oil pan) must be free of engine oil and ETC.
- B. Before assembling the timing chain cover, the liquid sealant TB1217H should be applied on the gap between cylinder head and cylinder block  
The part must be assembled within 5 minutes after sealant was applied.

Bead width : 2.5mm(0.1in.)

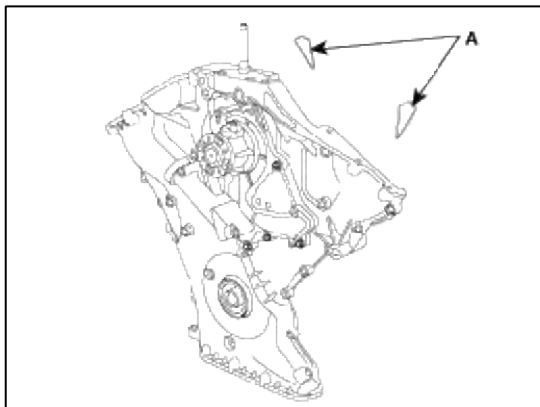


- C. After applying liquid sealant TB1217H on timing chain cover.  
The part must be assembled within 5 minutes after sealant was applied.  
Sealant should be applied without discontinuity.  
Sealant should also be applied all around the two holes of the dowel pins.

Bead width : 2.5mm(0.1in.)



D. Install the new gasket(A) to the timing chain cover.



E. The dowel pins on the cylinder block and holes on the timing chain cover should be used as a reference in order to assemble the timing chain cover to be in exact position.

### Tightening torque

B(17): 18.62 ~ 21.56Nm(1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lb-ft)

C(4): 9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

D(1): 58.80 ~ 68.80Nm(6.0 ~ 7.0kgf.m, 43.40 ~ 50.63lb-ft)

E(1): 58.80 ~ 68.80Nm(6.0 ~ 7.0kgf.m, 43.40 ~ 50.63lb-ft)

F(2): 24.50 ~ 26.46Nm(2.5 ~ 2.7kgf.m, 18.08 ~ 19.53lb-ft)

G(4): 21.56 ~ 23.52Nm(2.2 ~ 2.4kgf.m, 15.91 ~ 17.36lb-ft)

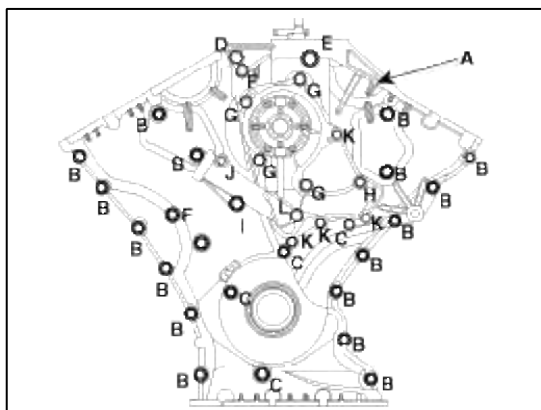
H(1): 9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

I(1): 9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

J(1): 9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

K(4): 9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

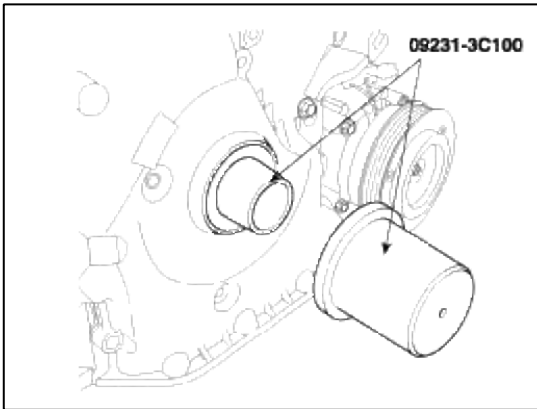
L(1): 21.56 ~ 26.46Nm(2.2 ~ 2.7kgf.m, 15.91 ~ 19.53lb-ft) - New bolt



F. The firing and/or blow out test should not be performed within 30 minutes after the timing chain cover was assembled.



22. Using SST(09231-3C100), install timing chain cover oil seal.



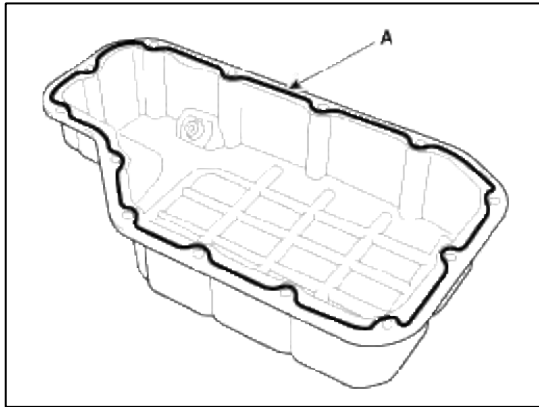
23. Install lower oil pan.

- A. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
- B. Before assembling the oil pan, the liquid sealant TB1217H should be applied on oil pan.  
The part must be assembled within 5 minutes after the sealant was applied.

---

Bead width : 2.5mm(0.1in.).

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**CAUTION**

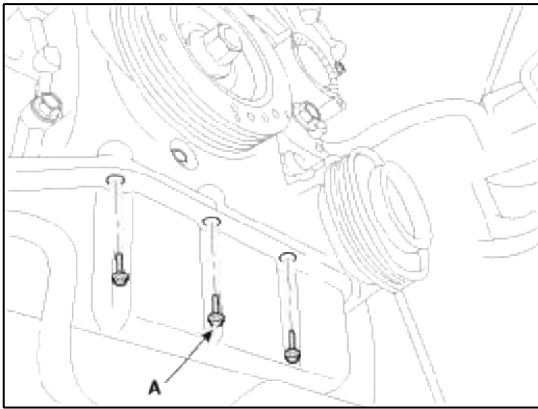
- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant.
- When applying sealant gasket, sealant must not be protruded into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket at the inner threads of the bolt holes.

**C. Install oil pan(A).**

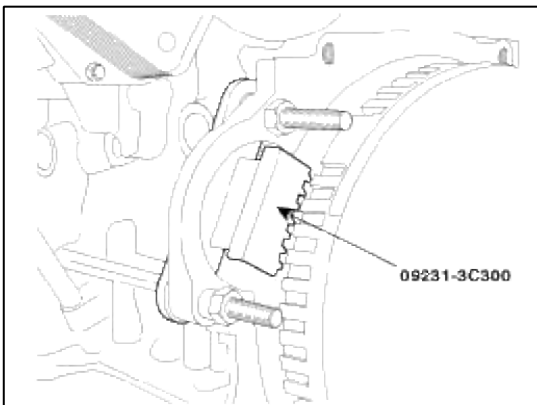
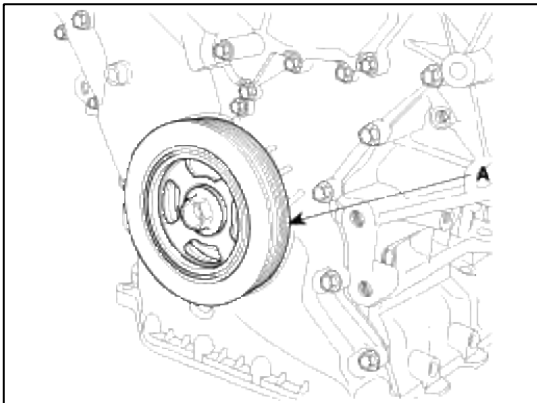
Uniformly tighten the bolts in several passes.

**Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

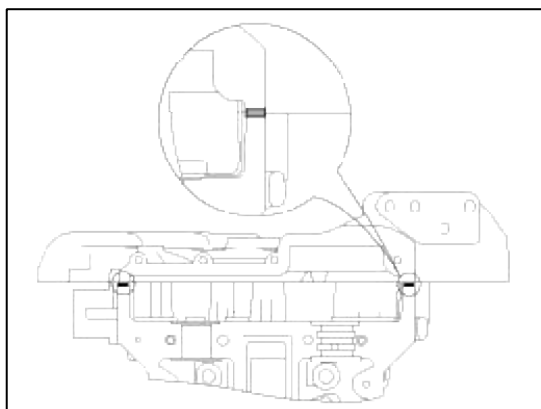
**24. Using SST(09231-3C300) install crankshaft damper pulley(A).****Tightening torque**

284.2 ~ 303.8Nm(29.0 ~ 31.0kgf.m, 209.76 ~ 224.22lb-ft)



## 25. Install cylinder head cover.

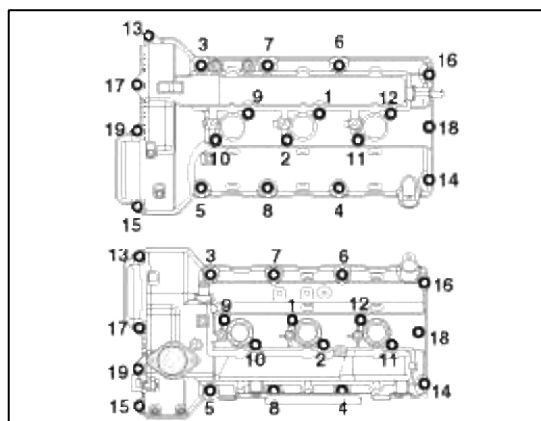
- A. The hardening sealant located on the upper area between timing chain cover and cylinder head should be removed before assembling cylinder head cover.
- B. After applying sealant(TB1217H), it should be assembled within 5 minutes.Bead width : 2.5mm(0.1in.)



- C. The firing and/or blow out test should not be performed within 30 minutes after the cylinder head cover was assembled.
- D. Install the cylinder head cover bolts as following method.

### Tightening torque

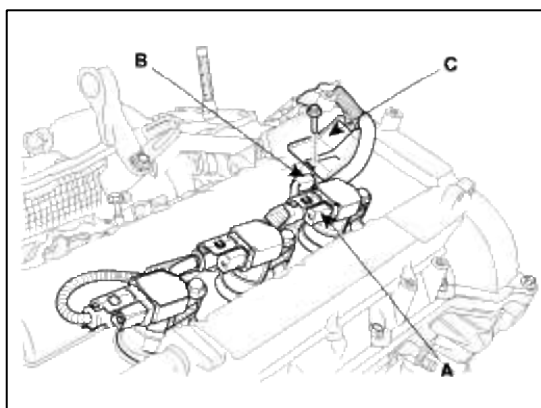
9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



### CAUTION

Do not reuse cylinder head cover gasket.

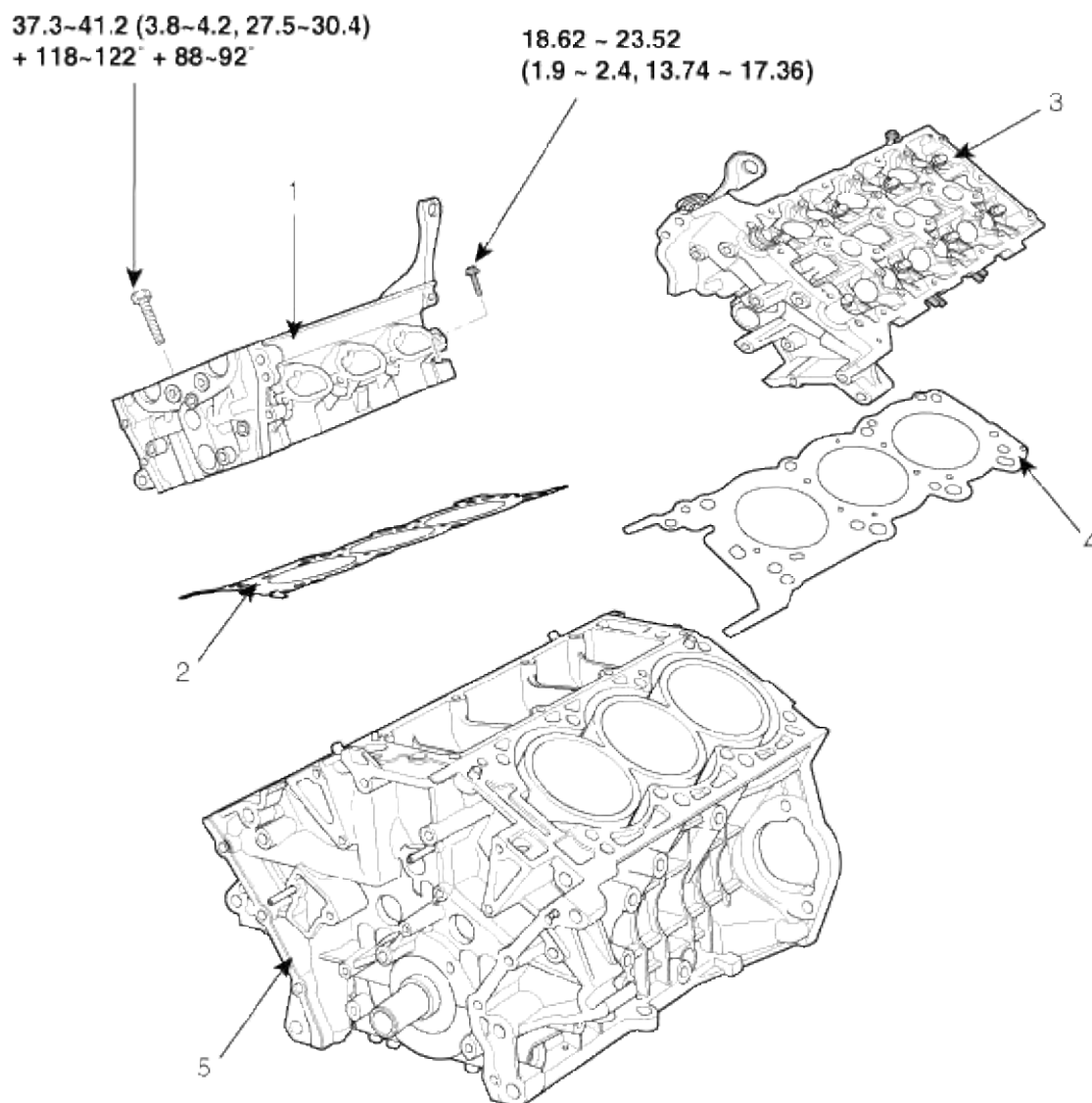
- E. Install ignition coil
- F. Connect RH ignition coil connector(A), condenser connector(B) and install wiring bracket(C).



- G. Install connector bracket from LH cylinder head cover.

# Engine Mechanical System > Cylinder Head Assembly > Components and Components Location

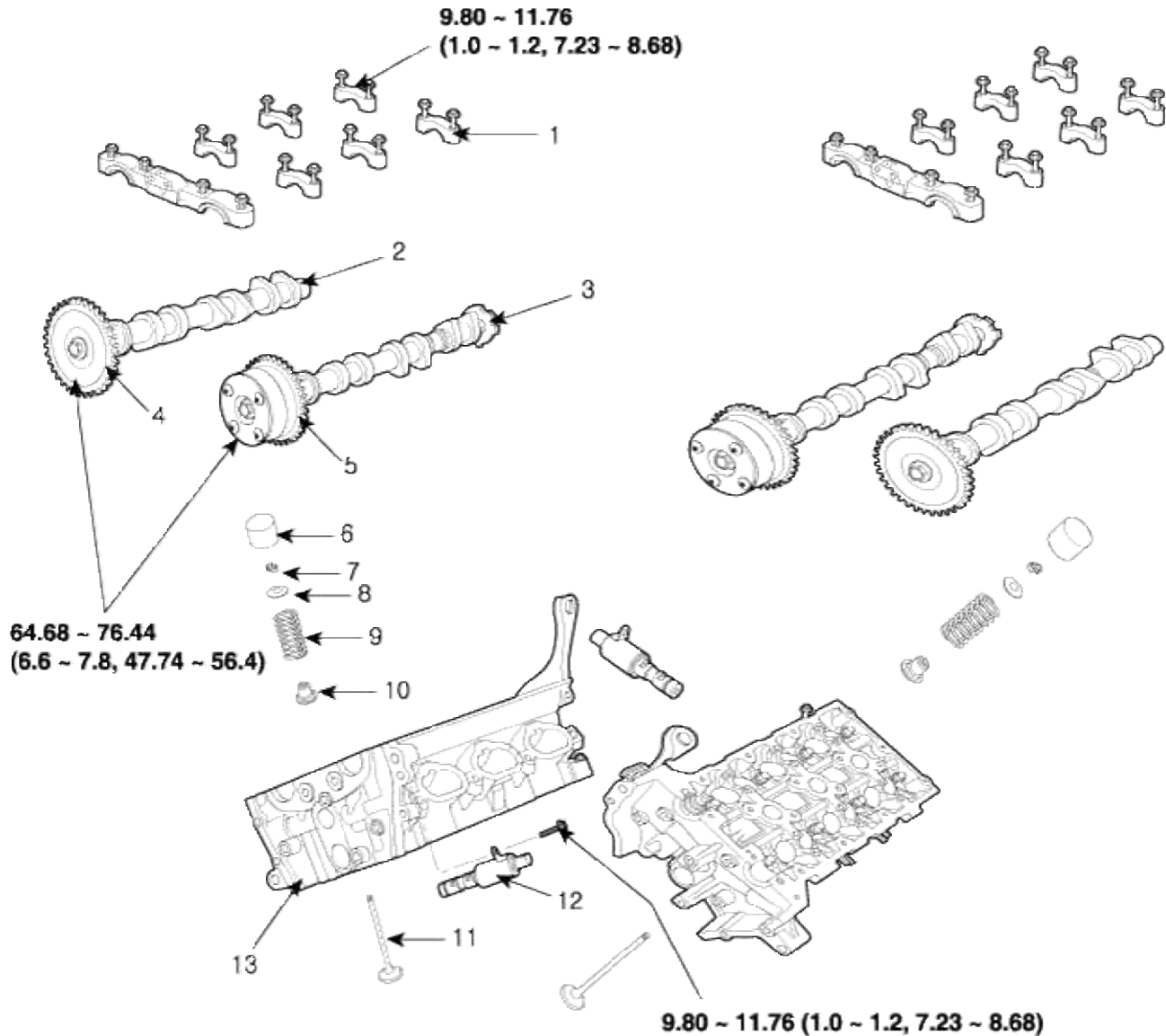
## COMPONENTS



**TORQUE : N.m (kgf.m, lbf.ft)**

- 1. RH cylinder head
- 2. RH cylinder head gasket
- 3. LH cylinder head

- 4. LH cylinder head gasket
- 5. Cylinder block



**TORQUE : N.m (kgf.m, lbf.ft)**

- |                              |                     |                   |
|------------------------------|---------------------|-------------------|
| 1. Camshaft bearing cap      | 6. MLA              | 11. Valve         |
| 2. Exhaust camshaft          | 7. Retainer lock    | 12. OCV           |
| 3. Intake camshaft           | 8. Retainer         | 13. Cylinder head |
| 4. Exhaust camshaft sprocket | 9. Valve spring     |                   |
| 5. CVVT assembly             | 10. Valve stem seal |                   |

**Engine Mechanical System > Cylinder Head Assembly > Repair procedures**

**REMOVAL**

**CAUTION**

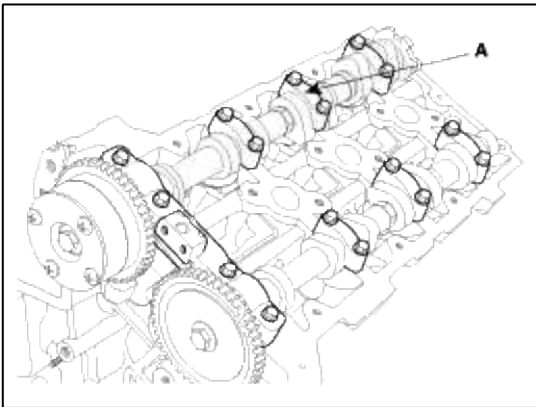
- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

**NOTE**

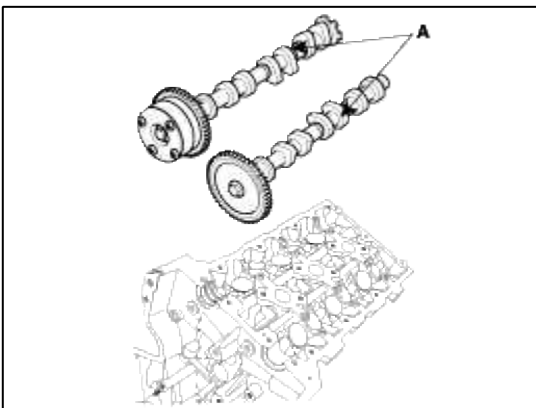
- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

Engine removal is required for this procedure.

1. Remove exhaust manifold.
2. Remove intake manifold.
3. Remove timing chain.
4. Remove water temperature control assembly.
5. Remove camshaft bearing cap(A).

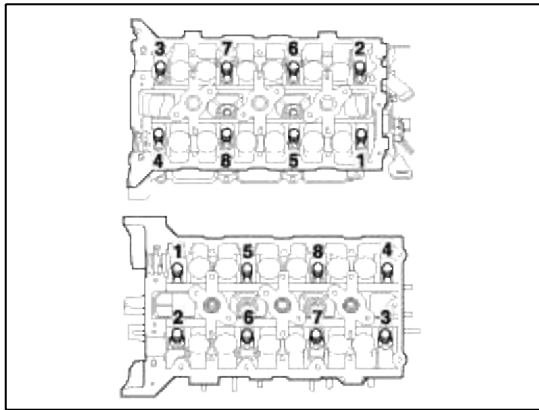


6. Remove camshaft assembly(A).



7. Remove cylinder head bolts, then remove cylinder head.

- (1) Uniformly loosen and remove the 16 cylinder head bolts, in several passes, in the sequence shown. Remove the 16 cylinder head bolts and plate washers.



**CAUTION**

Head warpage or cracking could result from removing bolts in an incorrect order.

- (2) Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

**CAUTION**

Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

## INSTALLATION

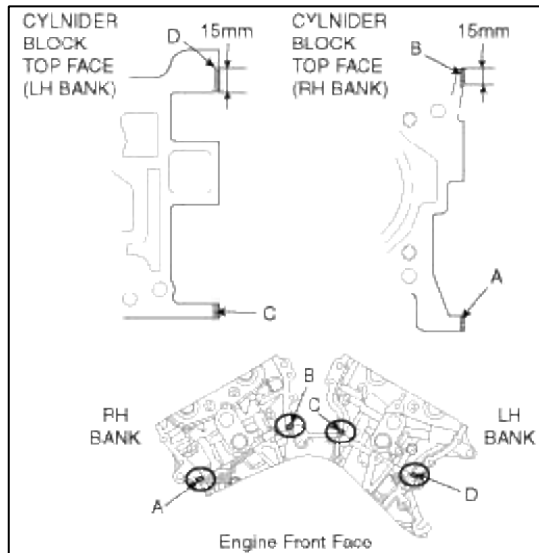
**NOTE**

- Thoroughly clean all parts to be assembled.
- Always use a new head and manifold gasket.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set the No.1 piston at TDC.

1. Install the cylinder head.

- A. The sealant locations on cylinder head and cylinder block must be free of engine oil and ETC.

- B. Apply sealant on cylinder block top face before assembling cylinder head gaskets.  
The part must be assembled within 5 minutes after sealant was applied.



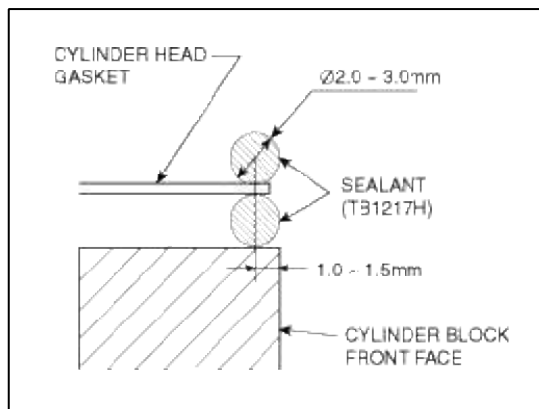
#### NOTE

Refer to below illustration to apply the sealant.

Bead width : 2.0~3.0 mm

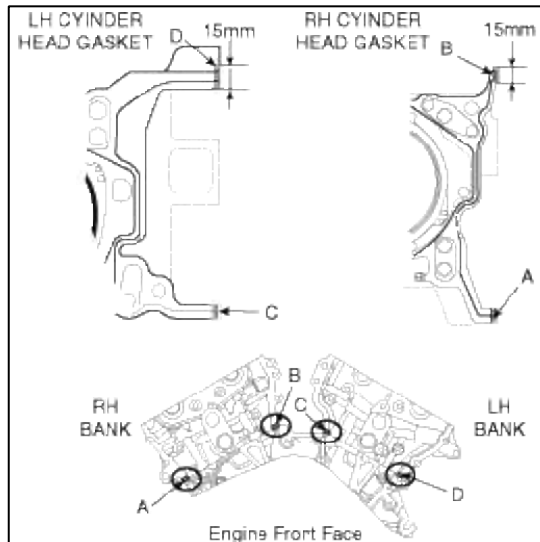
Sealant locations : 1.0~1.5mm from block surface

Recommended sealant : Liquid sealant TB1217H



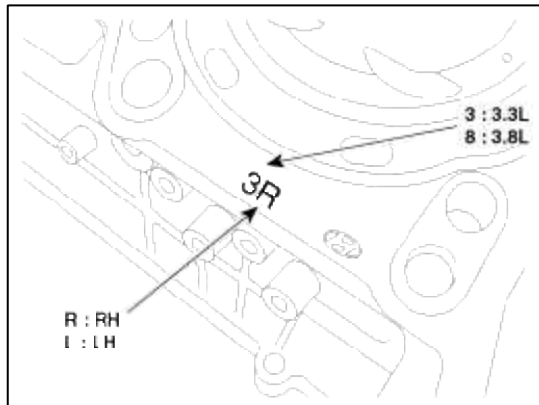


- C. Apply sealant on cylinder head gaskets after assembling cylinder head gaskets on cylinder block.  
The part must be assembled within 5 minutes after sealant was applied.



#### NOTE

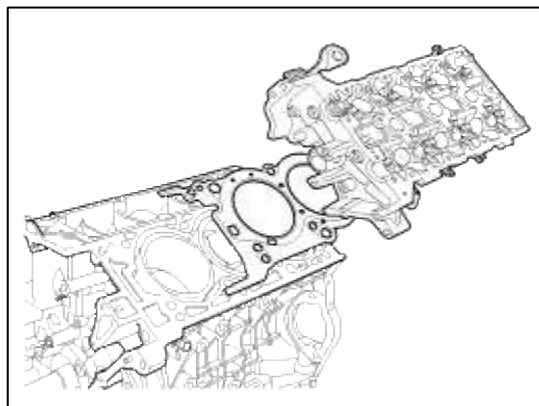
Be careful of the installation direction.



- D. Install the cylinder head.

#### NOTE

Remove the extruded sealant after assembling cylinder heads.



2. Place the cylinder head carefully in order not to damage the gasket with the bottom part of the end.

### 3. Install cylinder head bolts.

- (1) Do not apply engine oil on the threads and under the heads of the cylinder head bolts.
- (2) Using SST(09221-4A000), install and tighten the cylinder head bolts and plate washers, in several passes, in the sequence shown.

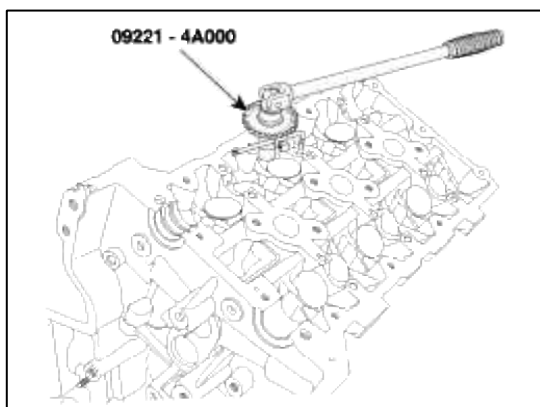
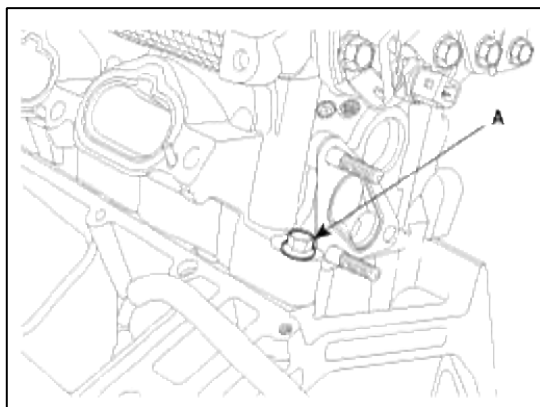
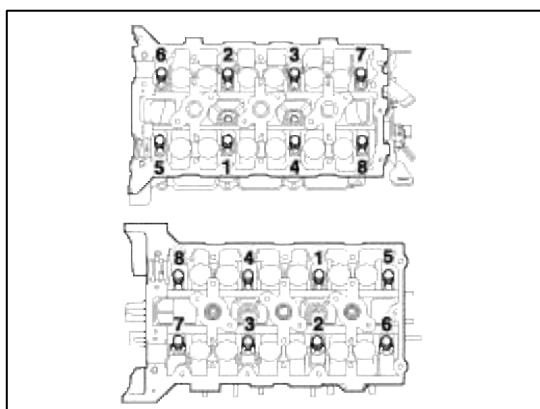
#### Tightening torque

Head bolt : 37.3~41.2Nm (3.8~4.2kgf.m, 27.5~30.4lb-ft) + 118~122° + 88~92°

Bolt (A) : 18.62 ~ 23.52Nm(1.9 ~ 2.4kgf.m, 13.74 ~ 17.36lb-ft)

#### NOTE

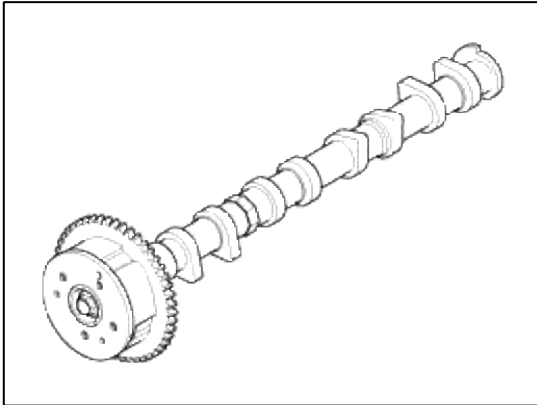
Always use new cylinder head bolt.



#### 4. Install the CVVT and camshaft sprocket.

##### **Tightening torque**

64.68 ~ 76.44Nm(6.6 ~ 7.8 kgf.m, 47.74 ~ 56.4lb-ft)



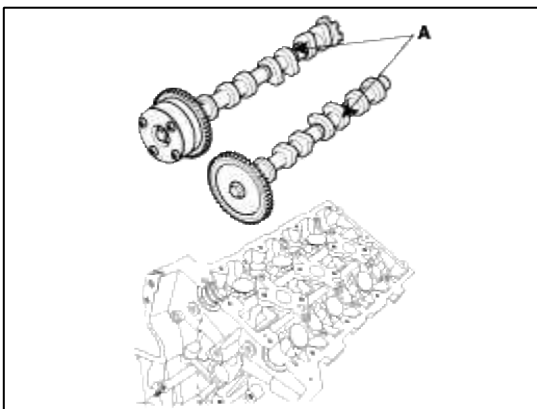
##### **NOTE**

- Install camshaft-inlet to dowel pin of CVVT assembly .  
At this time, attend not to be installed to oil hole of camshaft-inlet.
- Hold the hexagonal head wrench portion of the camshaft with a vise, and install the bolt and CVVT assembly.
- Do not rotate CVVT assembly when camshaft is installed to dowel pin of CVVT assembly.

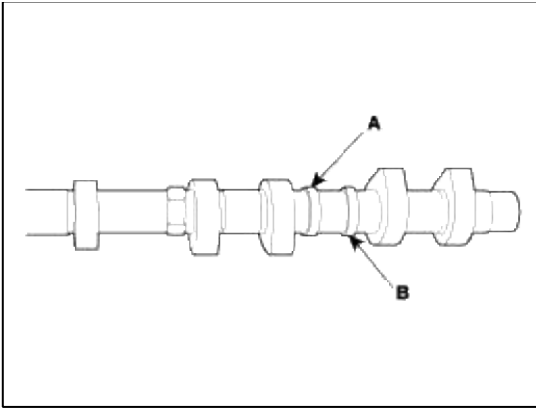
#### 5. Install camshafts(A).

##### **NOTE**

- Apply a light coat of engine oil on camshaft journals.
- Assemble the key groove of camshaft rear side to the same level of head top surface.
- Be careful the right, left bank, intake, exhaust side before assembling.

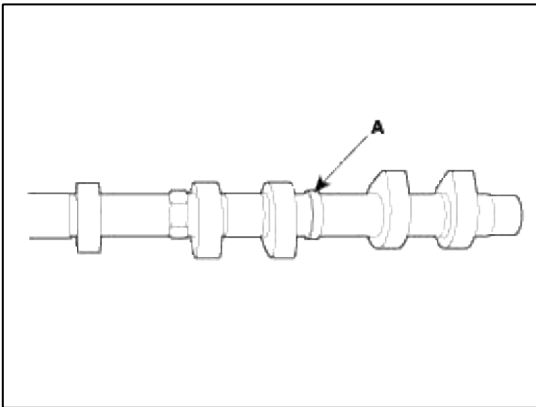


Intake camshaft

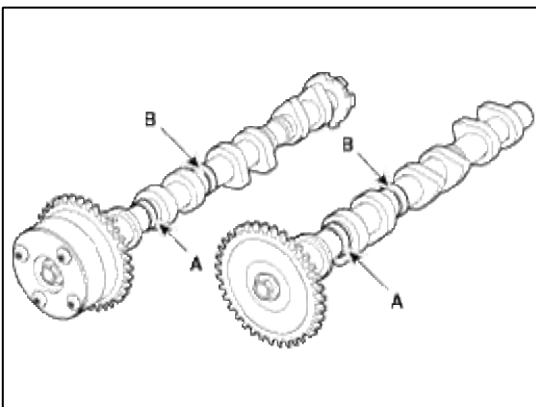


	<b>LH</b>	<b>RH</b>
3.3L	A: Ø27mm(1.0630in.) B: Ø27mm(1.0630in.)	A: Ø30mm(1.1811in.) B: Ø30mm(1.1811in.)
3.8L	A: Ø30mm(1.1811in.) B: Ø27mm(1.0630in.)	A: Ø27mm(1.0630in.) B: Ø30mm(1.1811in.)

#### Exhaust camshaft



	<b>LH</b>	<b>RH</b>
3.3L/3.8L	A: Ø27mm(1.0630in.)	A: Ø30mm(1.1811in.)



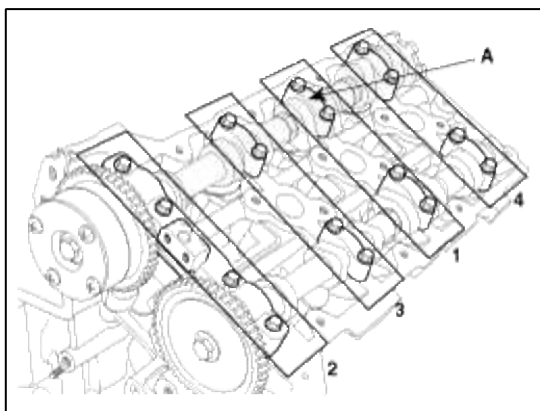
	<b>LH</b>	<b>RH</b>
3.3L	A: Ø30mm(1.1811in.) B: Ø27mm(1.0630in.)	A: Ø30mm(1.1811in.) B: Ø27mm(1.0630in.)
3.8L	A: Ø30mm(1.1811in.) B: Ø27mm(1.0630in.)	A: Ø30mm(1.1811in.) B: Ø27mm(1.0630in.)

6. Install camshaft bearing caps with the order below.

### Tightening torque

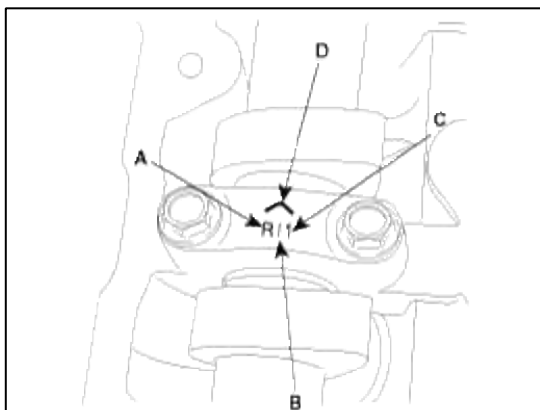
1st step : 5.9Nm(0.6kgf.m, 4.3lb-ft)

2nd step : 9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



### NOTE

Be careful the right, left bank, intake, exhaust side before assembling.



A : L(LH),R(RH)

B : I(Intake),None(Exhaust)

C : Journal number

D : Front mark

### CAUTION

Rotate the crankshaft not to contact the valves to the pistons by making the pistons below 10mm(0.3937in.) from the top of cylinder block.

7. Install water temperature control assembly.

8. Install timing chain.

9. Check and adjust valve clearance.

10. Install the exhaust manifold.

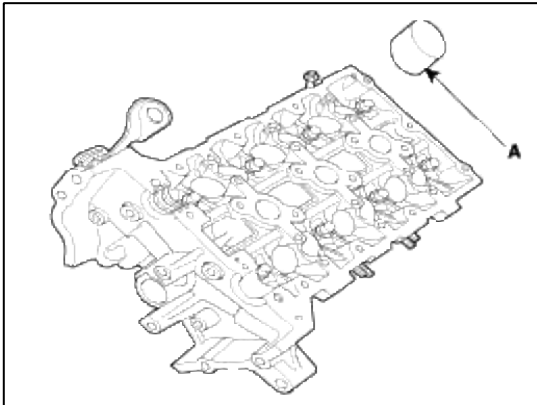
11. Install the intake manifold.

### DISASSEMBLY

**NOTE**

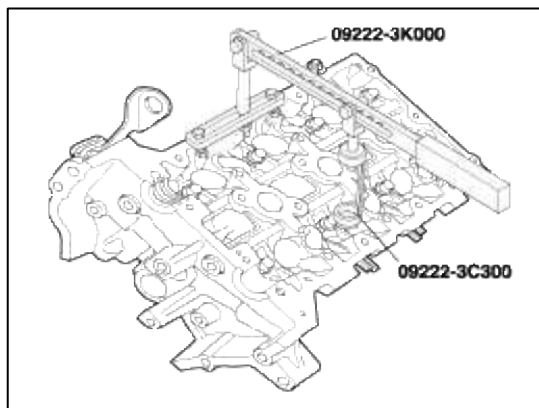
Identify MLA, valves and valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove MLAs(A).



2. Remove valves.

(1) Using SST(09222-3K000, 09222-3C300), compress the valve spring and remove retainer lock.

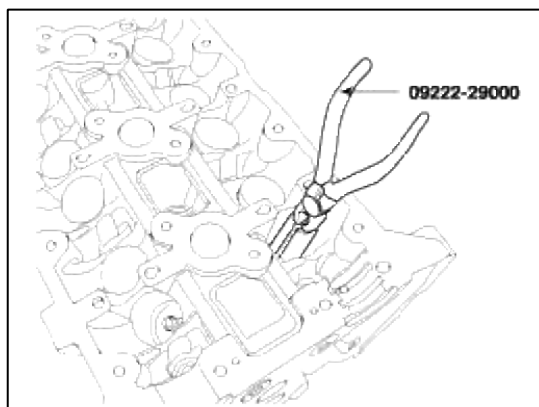


(2) Remove the spring retainer.

(3) Remove the valve spring.

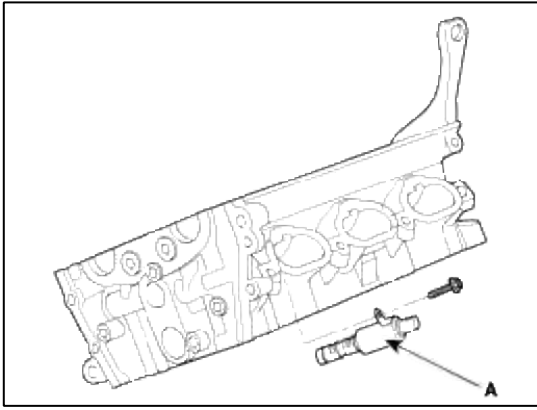
(4) Remove the valve.

(5) Using SST(09222-29000), remove the valve stem seal.

**NOTE**

Do not reuse old valve stem seals.

### 3. Remove OCV(A).



## INSPECTION

### CYLINDER HEAD

#### 1. Inspect for flatness.

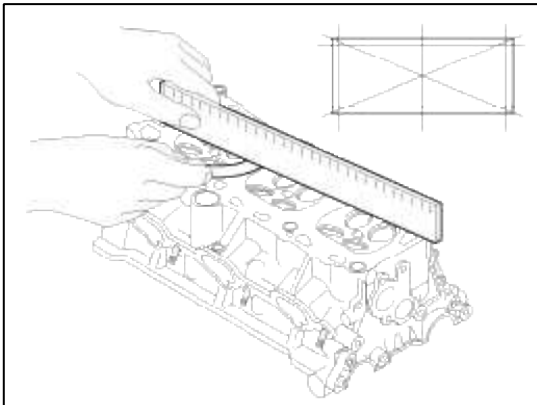
Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block and the manifolds for warpage.

#### **Flatness of cylinder head gasket surface**

Standard : Less than 0.05mm(0.002in.)[Less than 0.02mm(0.0008in.)/150x150]

#### **Flatness of manifold gasket surface**

Standard : Less than 0.03mm(0.001in)/110x110



#### 2. Inspect for cracks.

Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

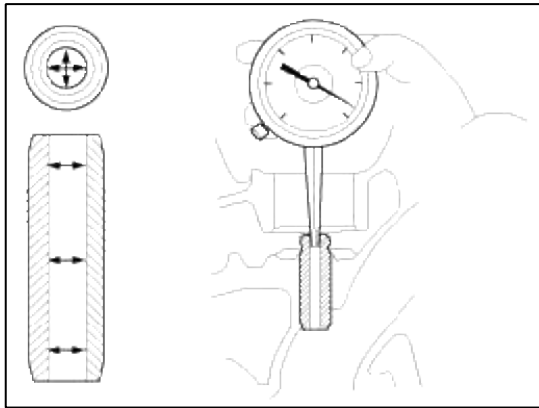
### VALVE AND VALVE SPRING

## 1. Inspect valve stems and valve guides.

- (1) Using a caliper gauge, measure the inside diameter of the valve guide.

**Valve guide I.D.**

Intake / Exhaust : 5.500 ~ 5.512mm (0.216 ~ 0.217in.)

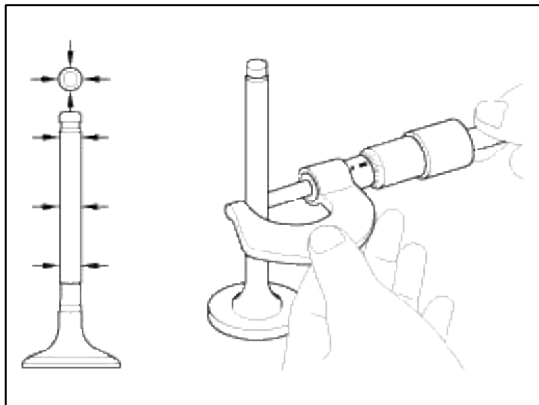


- (2) Using a micrometer, measure the diameter of the valve stem.

**Valve stem O.D.**

Intake : 5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)

Exhaust : 5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)



- (3) Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.

**Valve stem-to-guide clearance**

[Standard]

Intake : 0.020 ~ 0.047mm (0.0008 ~ 0.0018in.)

Exhaust : 0.030 ~ 0.054mm (0.0012 ~ 0.0021in.)

[Limit]

Intake : 0.07mm (0.0027in.)

Exhaust : 0.09mm (0.0035in.)



## 2. Inspect valves.

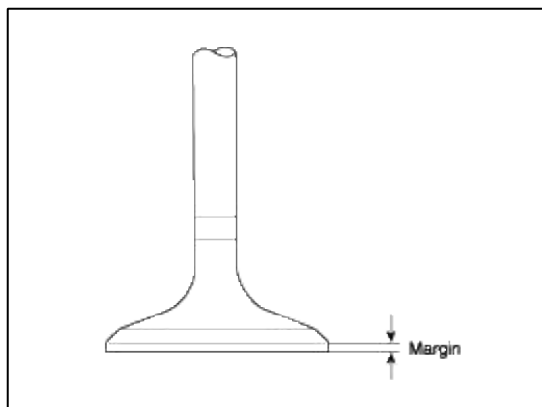
- (1) Check the valve is ground to the correct valve face angle.
- (2) Check that the surface of the valve for wear.  
If the valve face is worn, replace the valve.
- (3) Check the valve head margin thickness.  
If the margin thickness is less than minimum, replace the valve.

**Margin**

[Standard]

Intake : 1.56 ~ 1.86mm(0.06142 ~ 0.07323in.)

Exhaust : 1.73 ~ 2.03mm(0.06811 ~ 0.07992in.)



- (4) Check the valve length.

**Length**

Intake : 105.27mm (4.1445in)

Exhaust : 105.50mm (4.1535in)

- (5) Check the surface of the valve stem tip for wear.  
If the valve stem tip is worn, replace the valve.

## 3. Inspect valve seats

Check the valve seat for evidence of overheating and improper contact with the valve face.

If the valve seat is worn, replace cylinder head.

Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace cylinder head.

Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

## 4. Inspect valve springs.

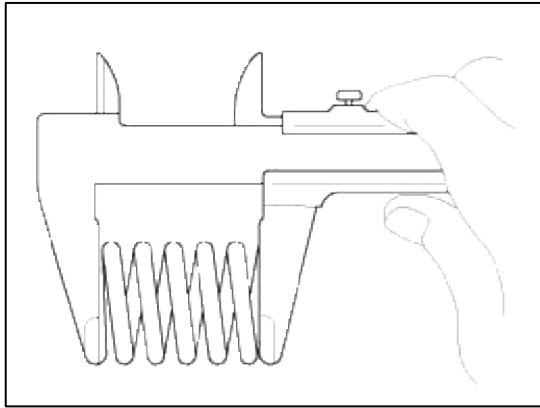
- (1) Using a steel square, measure the out-of-square of the valve spring.
- (2) Using a vernier calipers, measure the free length of the valve spring.

**Valve spring**

[Standard]

Free height : 43.86mm (1.7267in.)

Out-of-square : 1.5°

**MLA**

## 1. Inspect MLA.

Using a micrometer, measure the MLA outside diameter.

**MLA O.D.**

Intake/Exhaust : 34.964 ~ 34.980mm(1.3765 ~ 1.3771in.)

## 2. Using a caliper gauge, measure MLA tappet bore inner diameter of cylinder head.

**Tappet bore I.D.**

Intake/Exhaust : 35.000 ~ 35.025mm(1.3779 ~ 1.3789in.)

## 3. Subtract MLA outside diameter measurement from tappet bore inside diameter measurement.

**MLA to tappet bore clearance**

[Standard]

Intake/Exhaust : 0.020 ~ 0.061mm(0.0008 ~ 0.0024in.)

[Limit]

Intake/Exhaust : 0.07mm(0.0027in.)

**CAMSHAFT**

# 1. Inspect cam lobes.

Using a micrometer, measure the cam lobe height.

## Cam height

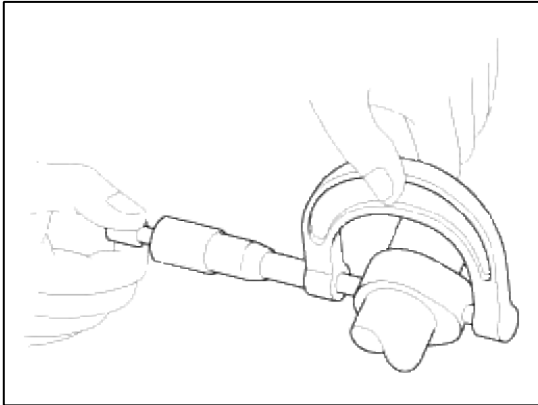
[Standard value]

Intake :

46.3mm (1.8228in.)(3.3L)

46.8mm (1.8425in.)(3.8L)

Exhaust : 45.8mm (1.8031in.)



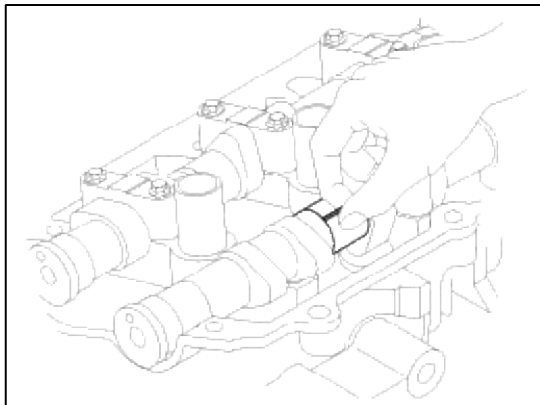
If the cam lobe height is less than standard, replace the camshaft.

# 2. Inspect camshaft journal clearance.

(1) Clean the bearing caps and camshaft journals.

(2) Place the camshafts on the cylinder head.

(3) Lay a strip of plastigage across each of the camshaft journal.



(4) Install the bearing caps.

## CAUTION

Do not turn the camshaft.

(5) Remove the bearing caps.

(6) Measure the plastigage at its widest point.

### Bearing oil clearance

[Standard value]

Intake

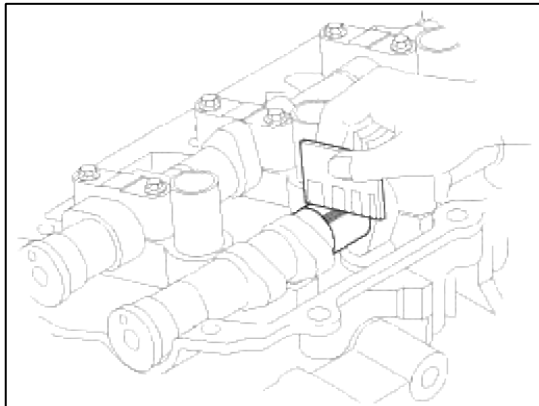
No.1 journal : 0.020 ~ 0.057mm (0.0008 ~ 0.0022in.)

No.2,3,4,, journal : 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)

Exhaust

No.1 journal : 0.020 ~ 0.057mm (0.0008 ~ 0.0022in.)

No.2,3,4,, journal : 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)



If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

(7) Completely remove the plastigage.

(8) Remove the camshafts.

3. Inspect camshaft end play.

(1) Install the camshafts.

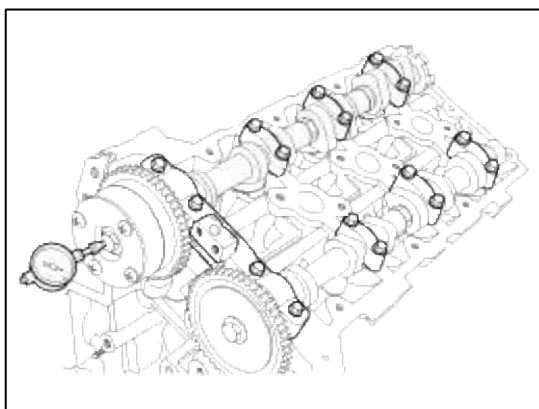
(2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

### Camshaft end play

[Standard value]

0.056 ~ 0.064mm(0.0022 ~ 0.0025in) - 3.3L

0.02 ~ 0.18mm (0.0008 ~ 0.0071in) - 3.8L



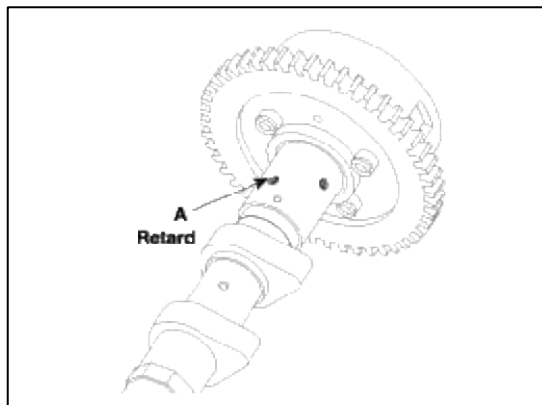
If the end play is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

(3) Remove the camshafts.

CVVT ASSEMBLY

## 1. Inspect CVVT assembly.

- (1) Check that the CVVT assembly will not turn.
- (2) Apply vinyl tape to the retard hole except the one indicated by the arrow in the illustration.



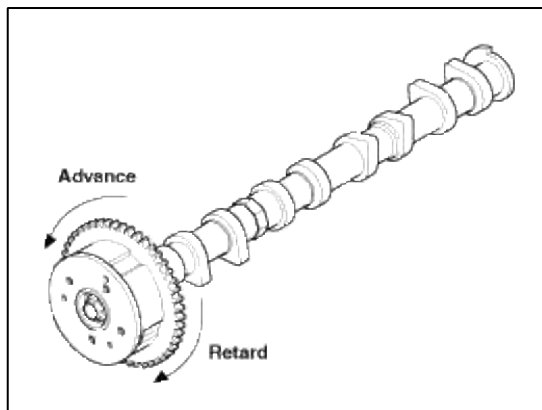
- (3) Wind tape around the tip of the air gun and apply air of approx. 150kpa(1.5kgf/cm<sup>2</sup>, 21psi) to the port of the camshaft.  
(Perform this order to release the lock pin for the maximum delay angle locking.)

**NOTE**

When the oil splashes, wipe it off with a shop rag.

- (4) Under the condition of (3), turn the CVVT assembly to the advance side (the arrow marked direction in the illustration) with your hand.

Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.



- (5) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

---

Standard: Movable smoothly in the range about 22.5°

---

- (6) Turn the CVVT assembly with your hand and lock it at the maximum delay angle position (clockwise).

**REASSEMBLY****NOTE**

Thoroughly clean all parts to be assembled.  
Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.  
Replace oil seals with new ones.

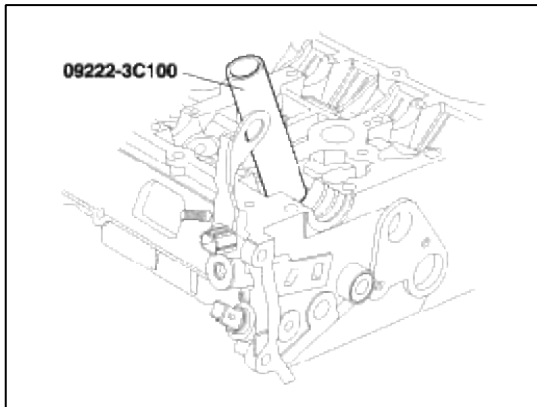
## 1. Install valves.

- (1) Using SST(09222-3C100), push in a new oil seal.

### NOTE

Do not reuse old valve stem seals.

Incorrect installation of the seal could result in oil leakage past the valve guides.

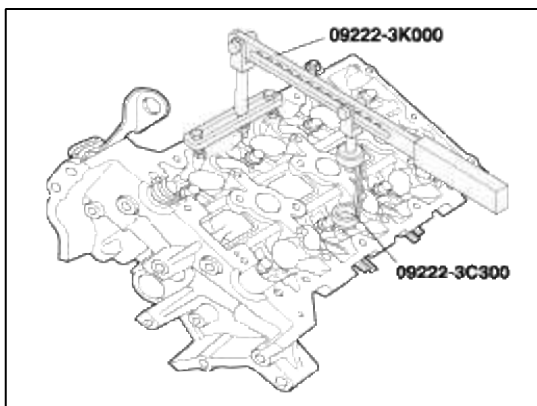


- (2) Install the valve, valve spring and spring retainer.

### NOTE

Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

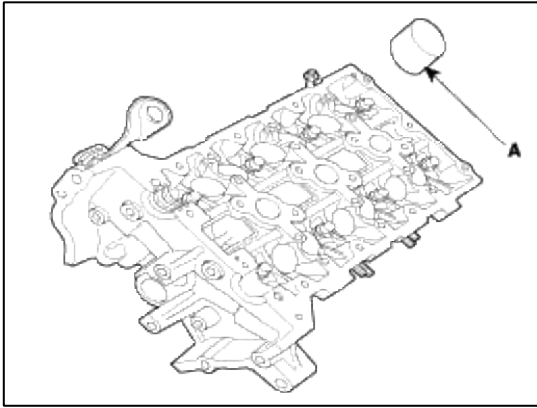
- (3) Using the SST(09222 - 3K000, 09222-3C300), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



- (4) Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.

## 2. Install MLAs.

Check that the MLA rotates smoothly by hand.

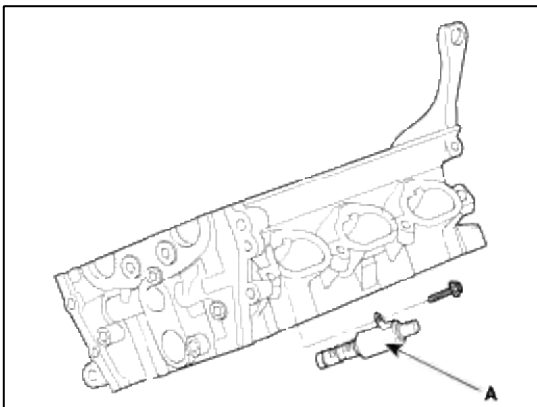
**NOTE**

MLA can be reinstalled in its original position.

## 3. Install OCV(A).

**Tightening torque**

9.80 ~ 11.76Nm(1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

**NOTE**

- To install OCV with gray colored connector into RH bank.
- To install OCV with black colored connector into LH bank.

**CAUTION**

- Do not reuse the OCV when dropped.
- Keep clean the OCV.
- Do not hold the OCV sleeve during servicing.
- When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.

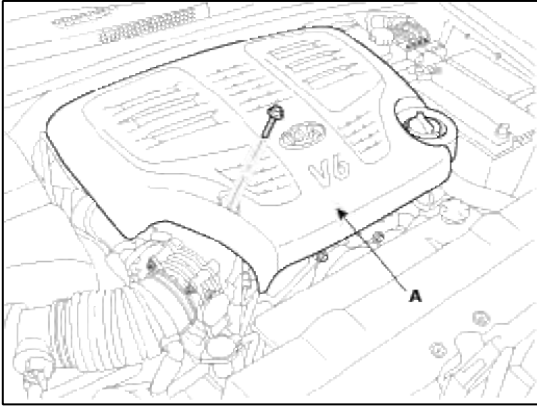
**CAUTION**

- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

**NOTE**

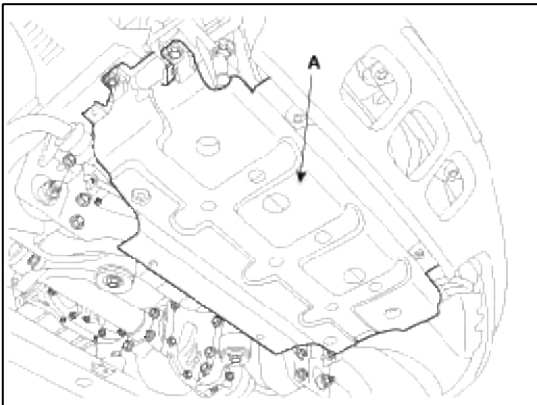
- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No.1 piston is at top dead center.

1. Remove the engine cover(A).



2. Recover refrigerant by opening the high & low pressure pipe caps and connecting the refrigerant station(Refer to Air conditioning system in HA Group).

3. Remove the under cover(A).



4. Drain engine oil, transaxle fluid and engine coolant.

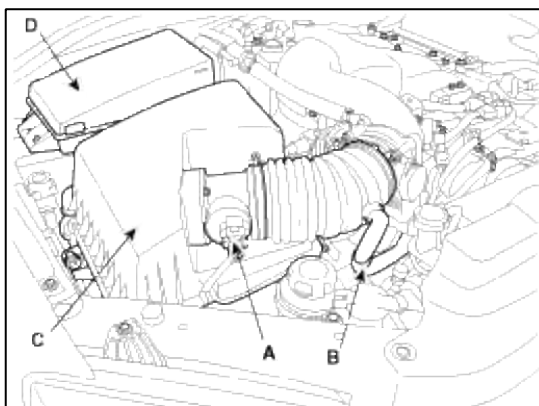
5. Disconnect the neagative terminal from the battery and remove the battery(A).

6. Remove the intake air hose and air cleaner assembly.

(1) Disconnect the MAF connector(A).

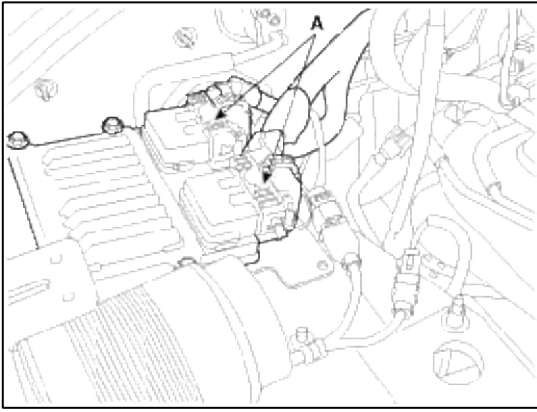
(2) Disconnect the breather hose(B) from air cleaner hose.

(3) Remove the intake air hose and air cleaner assembly(C) with the resonator(D).





7. Disconnect the PCM connectors(A).



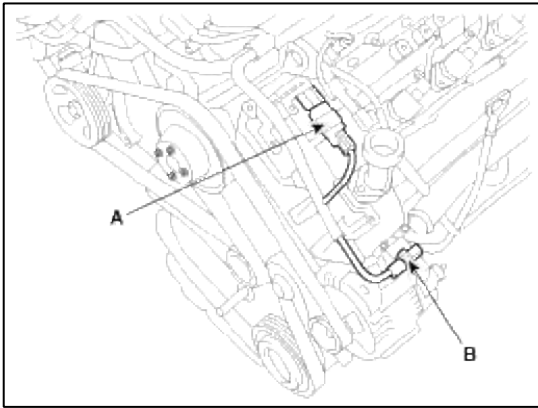
8. Remove the battery tray while recovering refrigerant.

9. Disconnect the high and low pressure pipes from the radiator or the compressor.(Refer to Air conditioning system in HA Group).

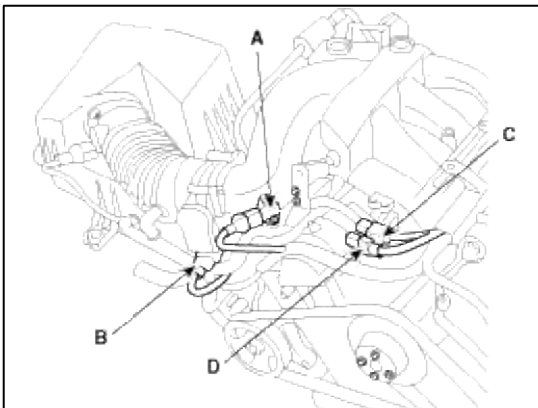
10. Remove the radiator.(Refer to Radiator in this Group).

11. Disconnect the engine wiring harness connectors.

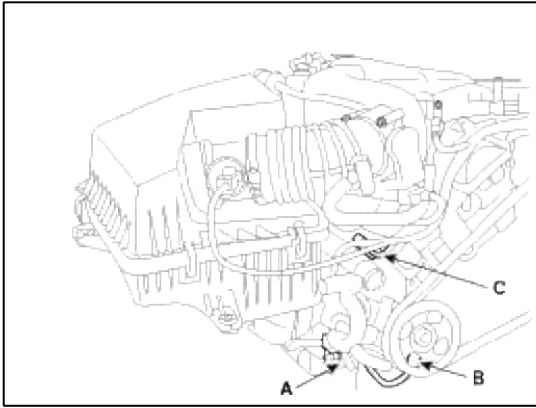
(1) Disconnect the oil control valve(OCV) harness connector(A) and the knock sensor(LH) harness connector(B)



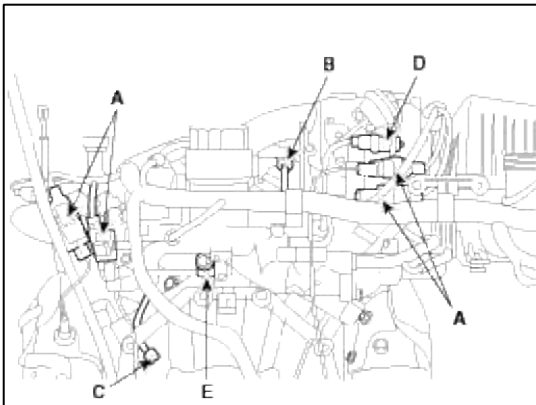
(2) Disconnect the MAP(A), ETC(B), ignition coil harness connector(C) and the injection harness connector(D).



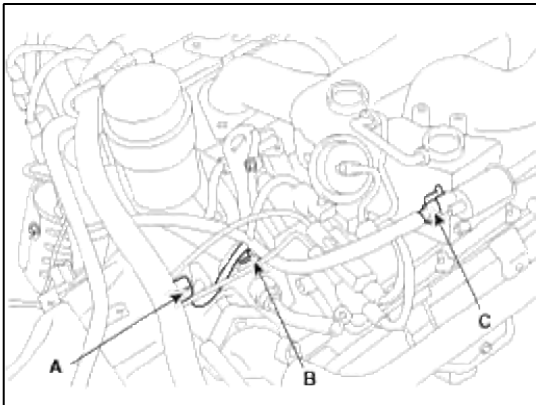
- (3) Disconnect the battery connector(A), the power steering switch connector(B) and the knock sensor(RH) harness connector(C).



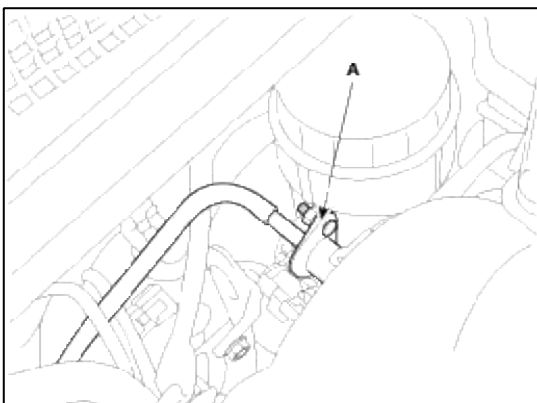
- (4) Disconnect the oxygen sensors(A), CMP(B), CKP(C), VIV(D) and the condensor harness connector(E).



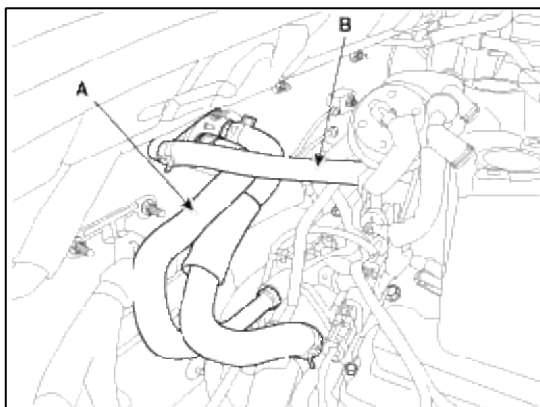
- (5) Disconnect the water temperature sensor(WTS) harness connector(A), the oil temperature sensor(OTS) harness connector(B) and the purge control solenoid valve(PCSV) harness connector(C).



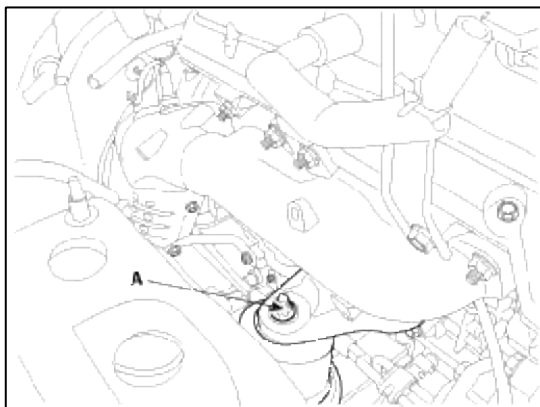
12. Disconnect the transaxle wire harness connector and remove the transaxle assembly.(Refer to Transaxle system in AT Group).
13. Disconnect the fuel hose tube(A).



14. Disconnect the front exhaust muffler with the exhaust manifolds.
15. Remove the front wheels and tires.(Refer to Suspension system in SS Group).
16. Remove heater hose(A) and disconnect the brake vacume hose(B).



17. Remove the exhaust and intake manifold covers.(Refer to Intake and exhaust system in this Group).
18. Remove the power steering pump assembly.(Refer to Power steering pump in ST Group).
19. Remove the hood assembly.(Refer to Hood in BD Group).
20. Install a jack for supporting the engine assembly.
21. Remove the engine mounting brackets(A).



22. Jack up the engine assembly in order to remove the engine from the vehicle.

## INSTALLATION

Installation is in the reverse order of removal.

Perform the following :

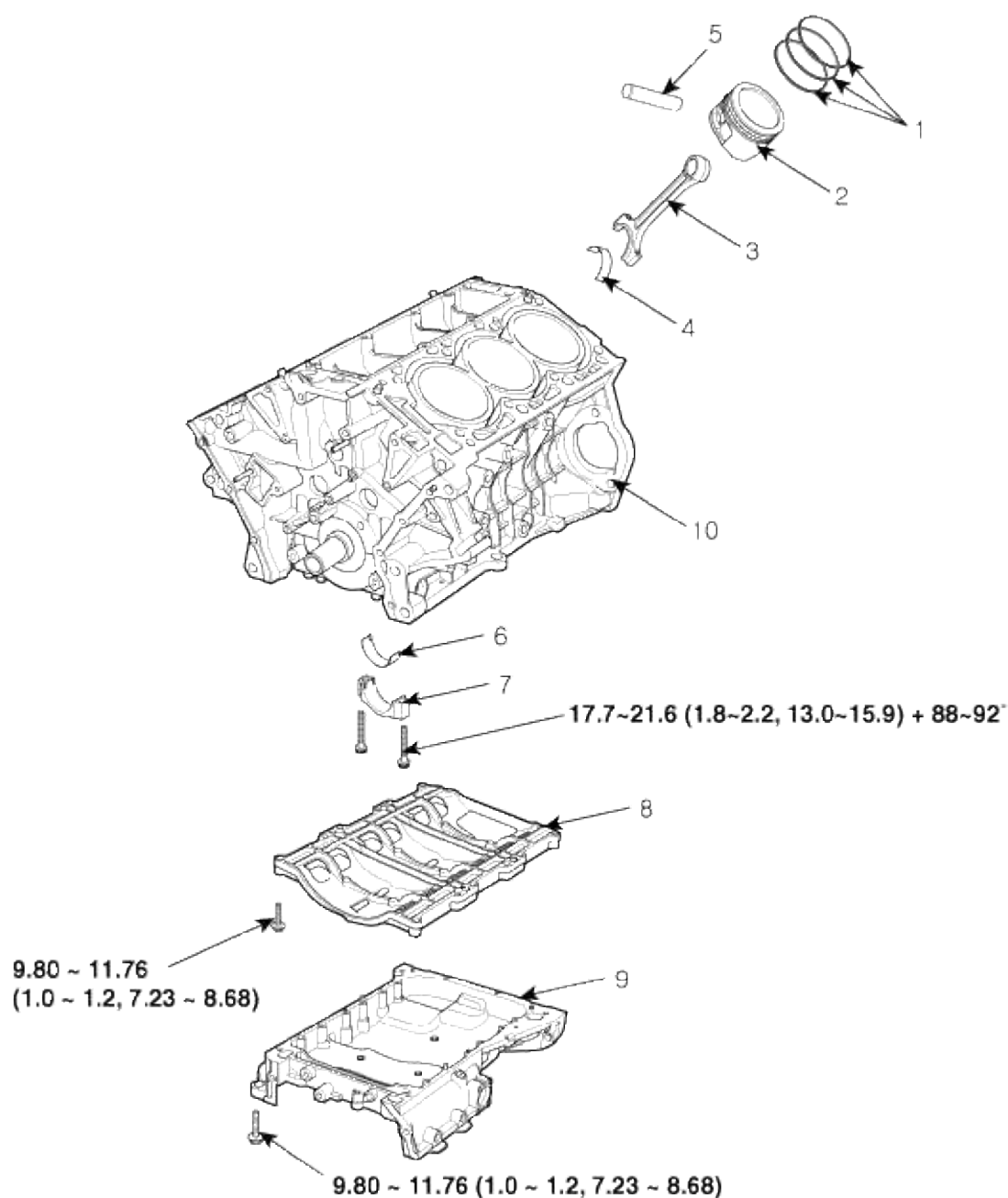
- Adjust the shift cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.

After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.

Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

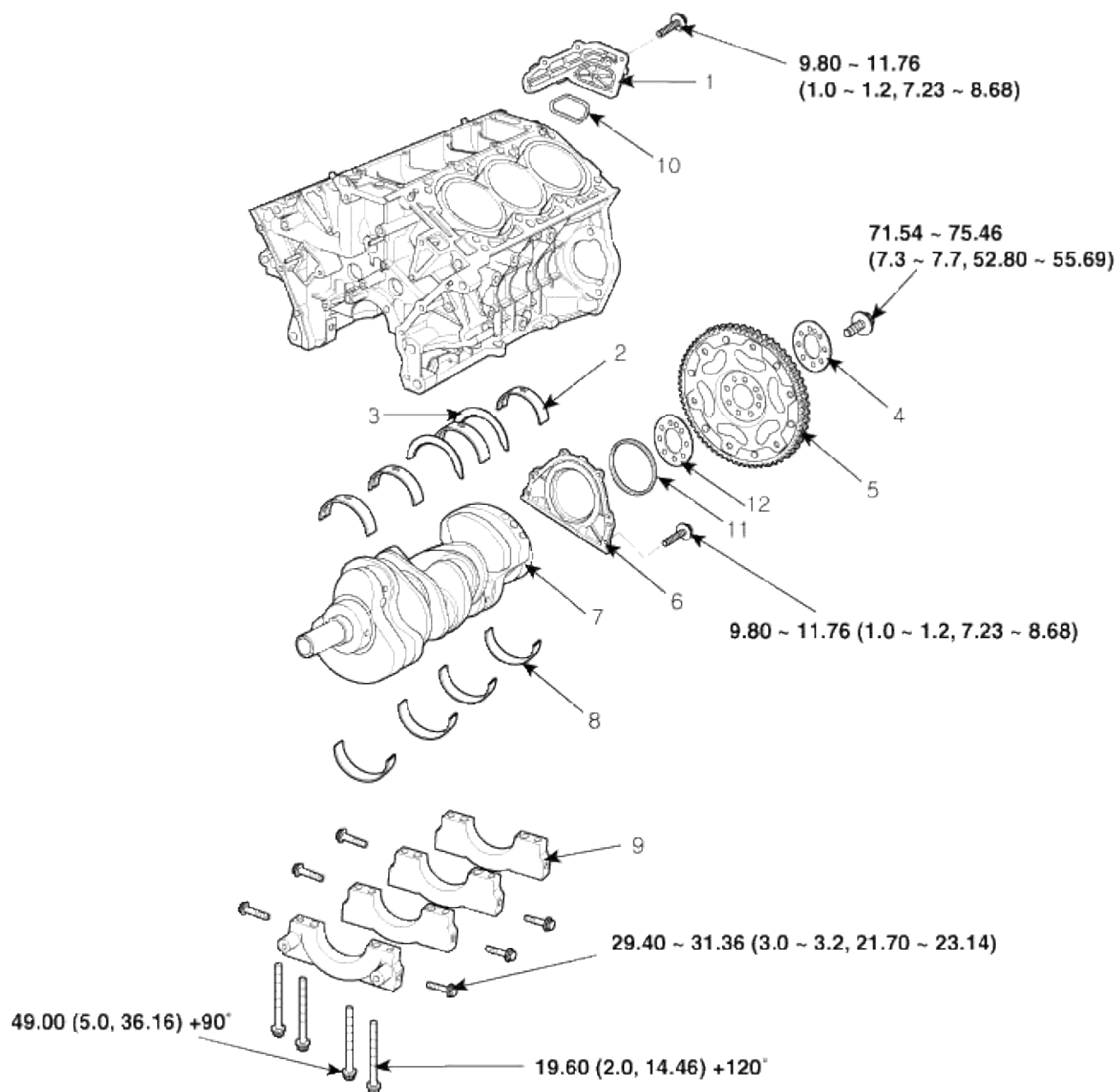
## Engine Mechanical System > Cylinder Block > Components and Components Location

### COMPONENTS


**TORQUE : N.m (kgf.m, lbf.ft)**

1. Piston ring
2. Piston
3. Connecting rod
4. Connecting rod upper bearing
5. Piston pin

6. Connecting rod lower bearing
7. Connecting rod bearing cap
8. Baffle plate
9. Upper oil pan
10. Cylinder block



#### TORQUE : N.m (kgf.m, lbf.ft)

- |                             |                             |
|-----------------------------|-----------------------------|
| 1. Oil drain cover          | 7. Crankshaft               |
| 2. Crankshaft upper bearing | 8. Crankshaft lower bearing |
| 3. Thrust bearing           | 9. Main bearing cap         |
| 4. Plate adaptor            | 10. Oil drain cover gasket  |
| 5. Drive plate              | 11. Rear oil seal           |
| 6. Rear oil seal case       | 12. Crank adapter           |

### Engine Mechanical System > Cylinder Block > Repair procedures

#### REMOVAL

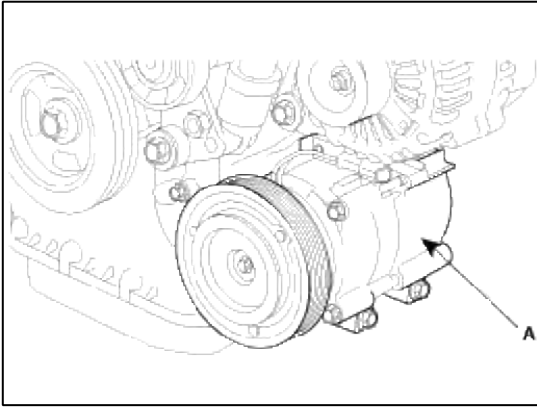
##### CAUTION

- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

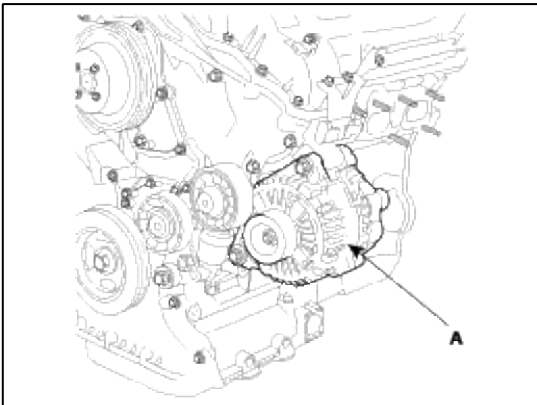
**NOTE**

- Mark all wiring and hoses to avoid misconnection.
- Inspection the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No.1 piston is at top dead center.

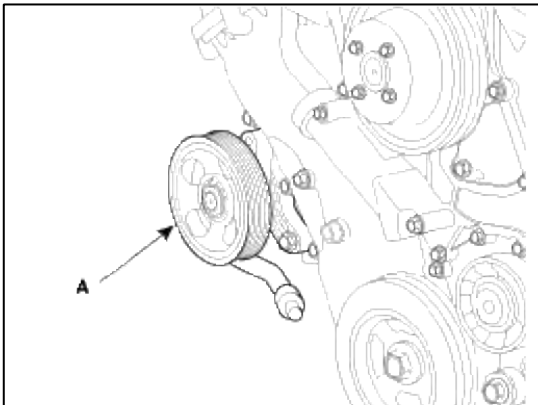
1. Remove exhaust manifold.
2. Remove intake manifold.
3. Remove timing chain.
4. Remove water temperature control assembly.
5. Remove cylinder head.
6. Remove oil pump.
7. Remove oil filter assembly.
8. Remove A/C compressor(A) from engine.



9. Remove alternator(A) from engine.



10. Remove power steering pump(A) from engine.

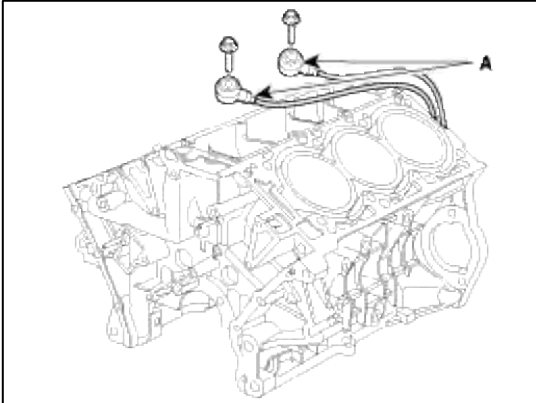
**INSTALLATION**

1. Install power steering pump.
2. Install alternator.

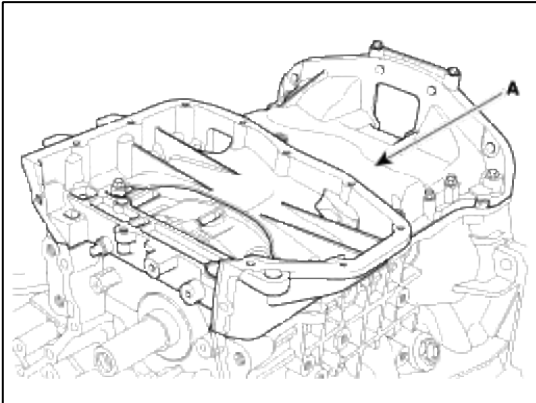
3. Install air compressor
4. Install oil filter assembly.
5. Install oil pump.
6. Install cylinder head.
7. Install water temperature control assembly.
8. Install timing chain.
9. Install intake manifold.
10. Install exhaust manifold.

## DISASSEMBLY

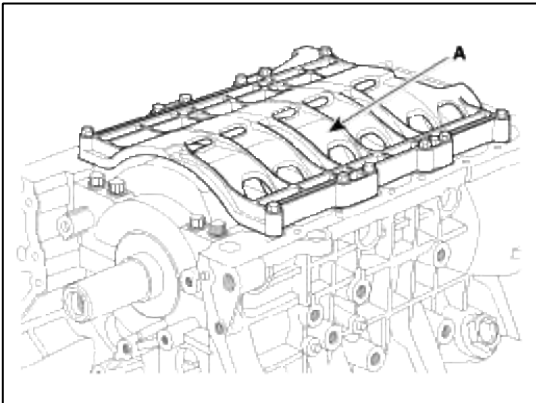
1. Remove drive plate.
2. Remove knock sensor(A).



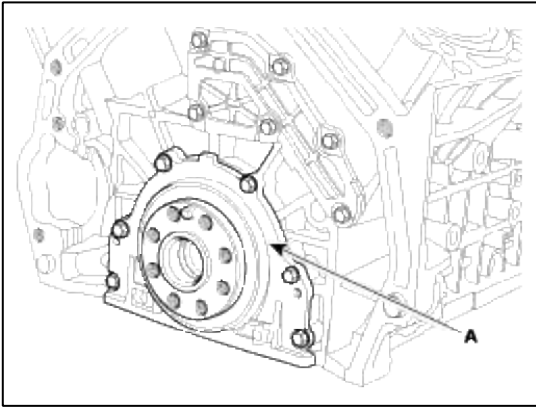
3. Remove upper oil pan(A).



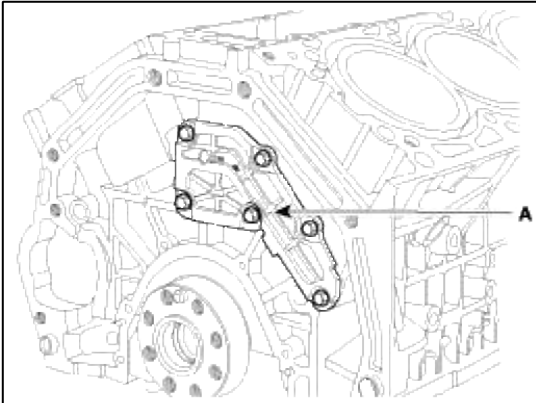
4. Remove baffle plate(A).



5. Remove rear oil seal case(A).



6. Remove oil drain cover(A).



7. Check the connecting rod end play.

8. Check the connecting rod oil clearance.

9. Remove piston and connecting rod assemblies.

(1) Using a ridge reamer, remove all the carbon from the top of the cylinder.

(2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

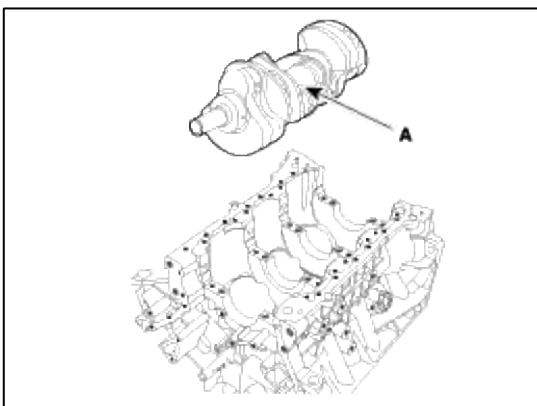
#### NOTE

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

10. Remove crankshaft main bearing cap and check oil clearance.

11. Check the crankshaft end play.

12. Lift the crankshaft(A) out of engine, being careful not to damage journals.



#### NOTE

Arrange the main bearings and thrust bearings in the correct order.



## 13. Check fit between piston and piston pin.

Try to move the piston back and forth on the piston pin. If any movement is felt, replace piston and piston pin as a set.

## 14. Remove piston rings.

- (1) Using a piston ring expander, remove the 2 compression rings.
- (2) Remove 2 side rails and the spacer by hand.

**NOTE**

Arrange the piston rings in the correct order only.

## 15. Disconnect connecting rod from piston.

**INSPECTION****CONNECTING ROD AND CRANKSHAFT**

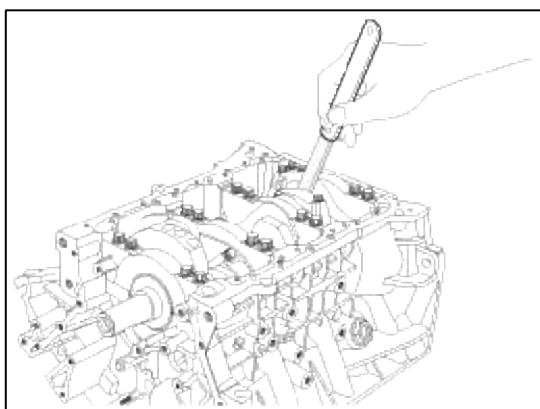
## 1. Check the connecting rod end play.

Using a feeler gauge, measure the end play while moving the connecting rod back and forth.

---

Standard end play : 0.1~ 0.25mm(0.004 ~ 0.010in.)

---



A. If out-of-tolerance, install a new connecting rod.

B. If still out-of-tolerance, replace the crankshaft.

## 2. Check the connecting rod bearing oil clearance.

- (1) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
- (2) Remove 2 connecting rod cap bolts.
- (3) Remove the connecting rod cap and bearing half.
- (4) Clean the crank pin and bearing.
- (5) Place plastigage across the crank pin.
- (6) Reinstall the bearing half and cap, and torque the bolts.

**Tightening torque**

17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

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**NOTE**

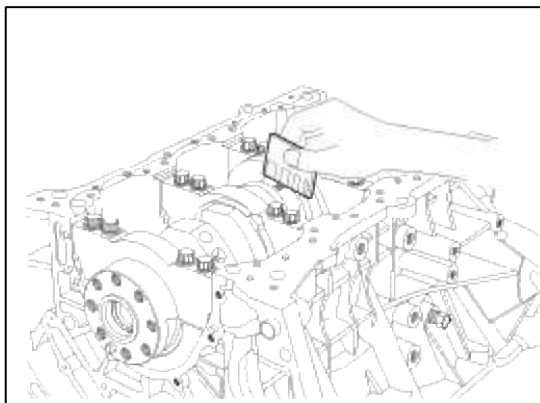
Do not turn the crankshaft.

- (7) Remove 2 bolts, connecting rod cap and bearing half.

- (8) Measure the plastigage at its widest point.

### Standard oil clearance

0.038 ~ 0.056mm(0.0015 ~ 0.0022in)



- (9) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

#### CAUTION

Do not file, shim, or scrape the bearings or the caps to adjust clearance.

- (10) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

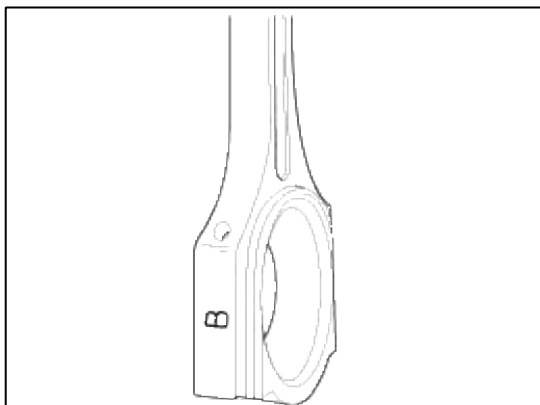
#### NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

#### CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

### CONNECTING ROD MARK LOCATION

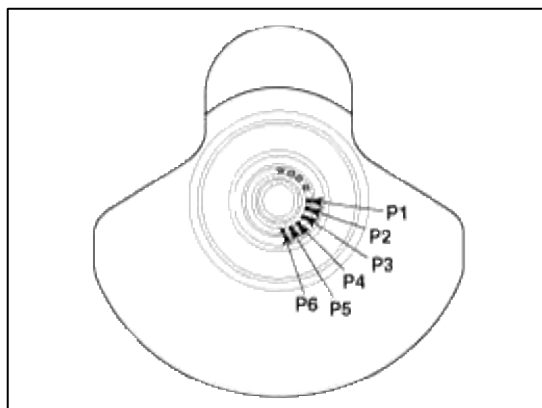


### DISCRIMINATION OF CONNECTING ROD

CLASS	MARK	INSIDE DIAMETER
0	a	58.000 ~ 58.006mm (2.2834 ~ 2.2837in.)
1	b	58.006 ~ 58.012mm (2.2837 ~ 2.2839in.)
2	c	58.012 ~ 58.018mm (2.2839 ~ 2.2842in.)

### CRANKSHAFT PIN MARK LOCATION

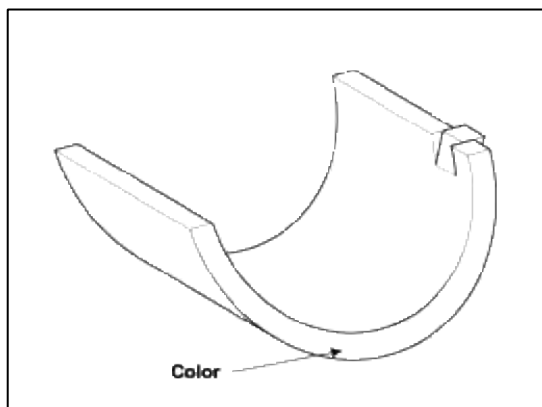
### DISCRIMINATION OF CRANKSHAFT



### DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	1 or A	54.966 ~ 54.972mm (2.1640 ~ 2.1642in.)
II	2 or B	54.960 ~ 54.966mm (2.1638 ~ 2.1640in.)
III	3 or C	54.954 ~ 54.960mm (2.1635 ~ 2.1638in.)

### PLACE OF IDENTIFICATION MARK (CONNECTING ROD BEARING)



### DISCRIMINATION OF CONNECTING ROD BEARING

CLASS	MARK	THICKNESS OF BEARING
E	BLUE	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
D	BLACK	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
C	BROWN	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
B	GREEN	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
A	YELLOW	1.502 ~ 1.505mm (0.0591 ~ 0.0593in.)

## (11) Selection

		CONNECTING ROD IDENTIFICATION MARK		
		0(a)	1(b)	2(c)
<b>CRANKSHAFT IDENTIFICATION MARK</b>	1 or A	A (YELLOW)	B (GREEN)	C (BROWN)
	2 or B	B (GREEN)	C (BROWN)	D (BLACK)
	3 or C	C (BROWN)	D (BLACK)	E (BLUE)

## 3. Check the crankshaft bearing oil clearance.

- (1) To check main bearing-to-journal oil clearance, remove the main bearing caps and bearing halves.
- (2) Clean each main journal and bearing half with a clean shop towel.
- (3) Place one strip of plastigage across each main journal.
- (4) Reinstall the bearings and caps, then torque the bolts.

**Tightening torque**

49.00Nm(5.0 kgf.m, 36.16lb-ft) + 90°

19.60 Nm(2.0 kgf.m, 14.46lb-ft)+ 120°

29.40 ~ 31.36Nm(3.0 ~ 3.2 kgf.m, 21.70 ~ 23.14lb-ft)

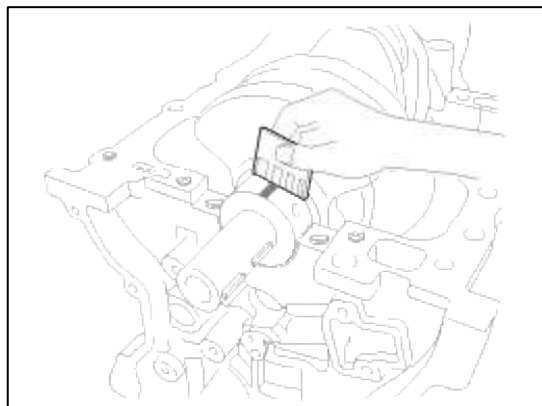
**NOTE**

Do not turn the crankshaft.

- (5) Remove the cap and bearing again, and measure the widest part of the plastigage.

### Standard oil clearance

0.022 ~ 0.040mm(0.0009 ~ 0.0016in)



- (6) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

#### CAUTION

Do not file, shim, or scrape the bearings or the caps to adjust clearance.

- (7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

#### NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

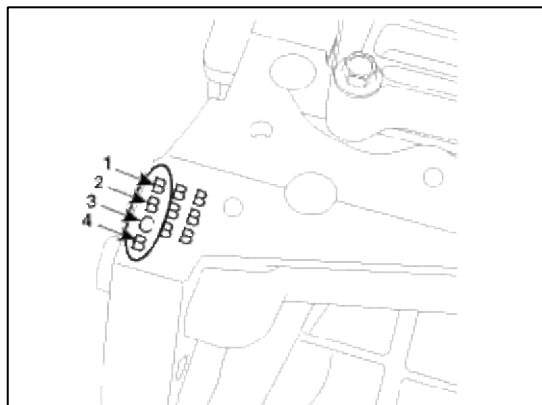
#### CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

### Crankshaft bore mark location

Letters have been stamped on the block as a mark for the size of each of the 5 main journal bores.

Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct bearings.

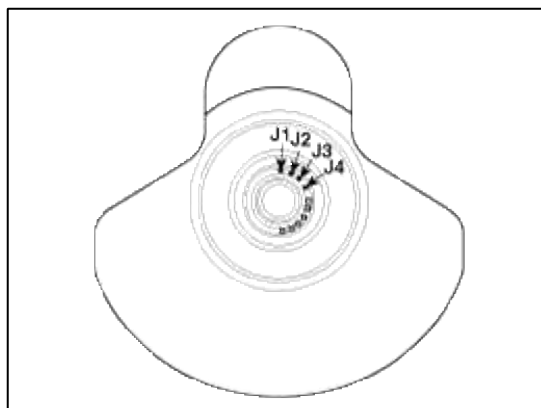


### DISCRIMINATION OF CYLINDER BLOCK

CLASS	MARK	INSIDE DIAMETER
a	A	73.500 ~ 73.506mm (2.8937 ~ 2.8939in.)
b	B	73.506 ~ 73.512mm (2.8939 ~ 2.8942in.)
c	C	73.512 ~ 73.518mm (2.8942 ~ 2.8944in.)

## CRANKSHAFT JOURNAL MARK LOCATION

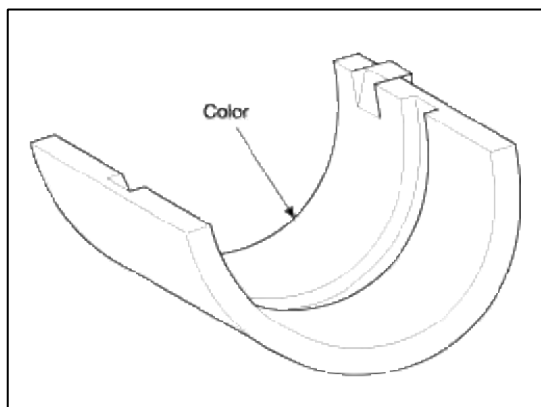
### DISCRIMINATION OF CRANKSHAFT



### DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	A	68.954 ~ 68.960mm (2.7147 ~ 2.7150in.)
II	B	68.948 ~ 68.954mm (2.7145 ~ 2.7147in.)
III	C	68.942 ~ 68.948mm (2.7142 ~ 2.7145in.)

## PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING)



### DISCRIMINATION OF CRANKSHAFT BEARING

CLASS	MARK	THICKNESS OF BEARING
E	BLUE	2.277 ~ 2.280mm (0.0896 ~ 0.0897in.)
D	BLACK	2.274 ~ 2.277mm (0.0895 ~ 0.0896in.)
C	BROWN	2.271 ~ 2.274mm (0.0894 ~ 0.0895in.)
B	GREEN	2.268 ~ 2.271mm (0.0893 ~ 0.0894in.)
A	YELLOW	2.265 ~ 2.268mm (0.0892 ~ 0.0893in.)

## SELECTION

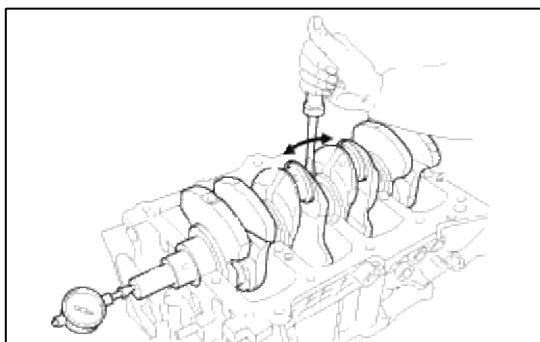
		CRANKSHAFT BORE IDENTIFICATION MARK		
		a(A)	b(B)	c(C)
CRANKSHAFT IDENTIFICATION MARK	1 or A	A (YELLOW)	B (GREEN)	C (BROWN)
	2 or B	B (GREEN)	C (BROWN)	D (BLACK)
	3 or C	C (BROWN)	D (BLACK)	E (BLUE)

### 4. Check crankshaft end play.

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

#### Standard end play

0.10 ~ 0.28mm (0.0039 ~ 0.0110in.)



If the end play is greater than maximum, replace the thrust bearings as a set.

#### Thrust bearing thickness

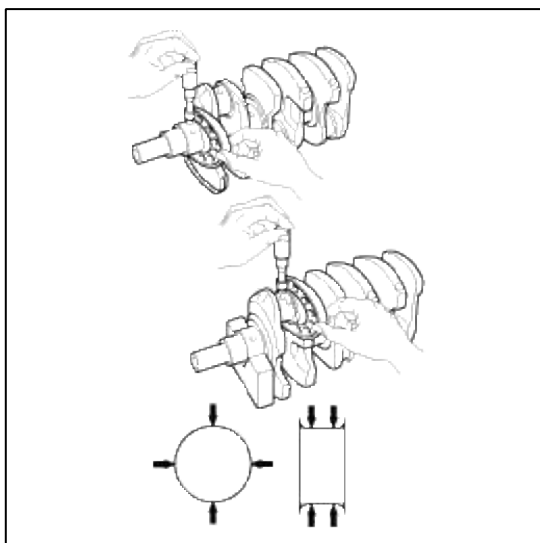
2.41 ~ 2.45mm (0.0949 ~ 0.0964in)

## 5. Inspect main journals and crank pins

Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter : 68.942 ~ 68.960mm(2.7142 ~ 2.7149in)

Crank pin diameter : 54.954 ~ 54.972mm(2.1635 ~ 2.1642in.)



## CONNECTING RODS

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match.  
When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod :

0.05mm / 100mm (0.0020 in./3.94 in.) or less

Allowable twist of connecting rod :

0.1mm / 100mm (0.0039 in./3.94 in.) or less

## CYLINDER BLOCK

1. Remove gasket material.  
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
2. Clean cylinder block  
Using a soft brush and solvent, thoroughly clean the cylinder block.

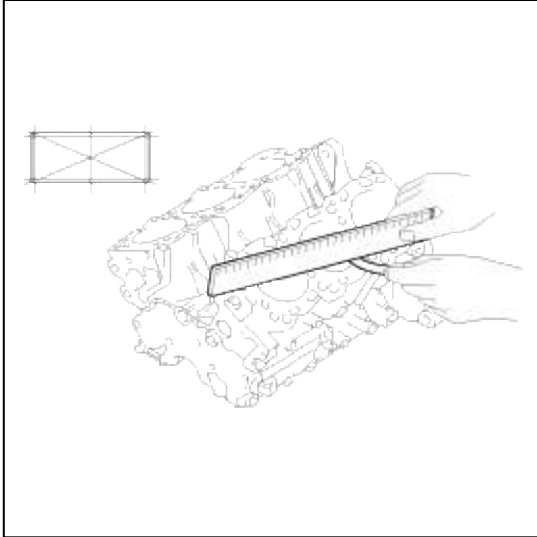


### 3. Inspect top surface of cylinder block for flatness.

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface

Standard : Less than 0.05mm(0.0020 in.), Less than 0.02mm(0.0008in.) / 150 x 150



### 4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.

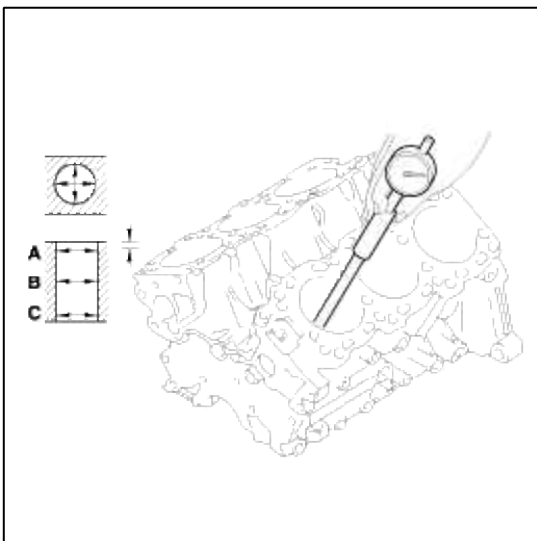
### 5. Inspect cylinder bore diameter

Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial directions.

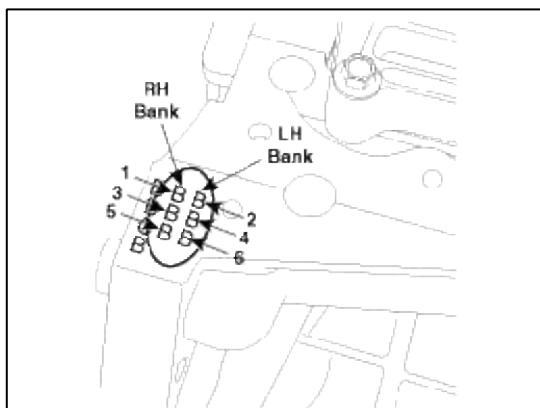
#### Standard diameter

92.00 ~ 92.03mm(3.6220 ~ 3.6232in) - 3.3L

96.00 ~ 96.03mm(3.7795 ~ 3.7807in) - 3.8L

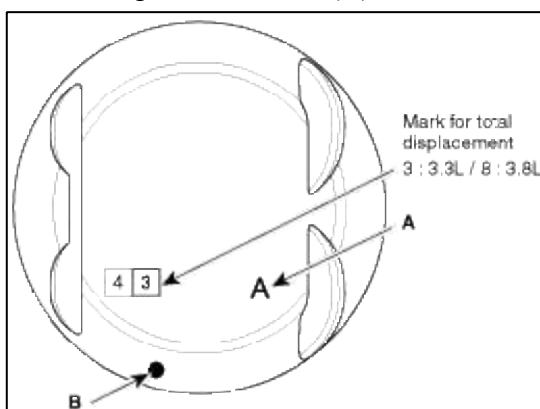


6. Check the cylinder bore size code on the cylinder block.



Class	Size code	Cylinder bore inner diameter	
		3.3L	3.8L
A	A	92.00~92.01mm (3.6220 ~ 3.6224in)	96.00 ~ 96.01mm (3.7795 ~ 3.7799in)
B	B	92.01~92.02mm (3.6224 ~ 3.6228in)	96.01 ~ 96.02mm (3.7799 ~ 3.7803in)
C	C	92.02~92.03mm (3.6228 ~ 3.6232in)	96.02 ~ 96.03mm (3.7803 ~ 3.7807in)

7. Check the piston size code(A) and the front mark(B) on the piston top face.



Class	Size code	Piston outer diameter	
		3.3L	3.8L
A	A	91.96~91.97mm (3.6205 ~ 3.6209in.)	95.96 ~ 95.97mm (3.7779 ~ 3.7783in)
B	B	91.97~91.98mm (3.6209 ~ 3.6213in.)	95.97 ~ 95.98mm (3.7783 ~ 3.7787in)
C	C	91.98~91.99mm (3.6213 ~ 3.6219in.)	95.98 ~ 95.99mm (3.7787 ~ 3.7791in)

8. Select the piston related to cylinder bore class.

**Clearance :**

0.03 ~ 0.05mm(0.0012 ~ 0.0020in)

## 1. Clean piston

- (1) Using a gasket scraper, remove the carbon from the piston top.
- (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
- (3) Using solvent and a brush, thoroughly clean the piston.

**NOTE**

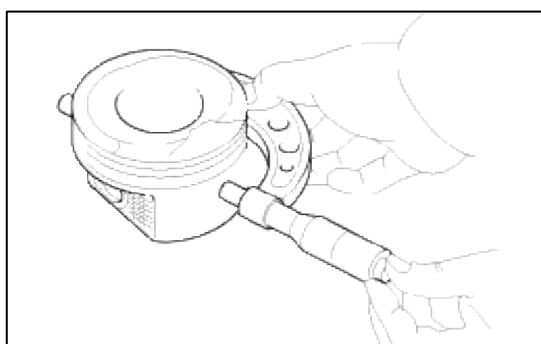
Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 14 mm (0.5512 in.) from the bottom of the piston.

**Standard diameter**

91.96 ~ 91.99mm(3.6205 ~ 3.6216in) - 3.3L

95.96 ~ 95.99mm(3.7779 ~ 3.7791in) - 3.8L



3. Calculate the difference between the cylinder bore diameter and the piston diameter.

**Piston-to-cylinder clearance**

0.03 ~ 0.05mm(0.0012 ~ 0.0020in)

4. Inspect the piston ring side clearance.

Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

**Piston ring side clearance**

Standard

No.1 : 0.03 ~ 0.07mm(0.0012 ~ 0.0027in)

No.2 : 0.03 ~ 0.07mm(0.0012 ~ 0.0027in)

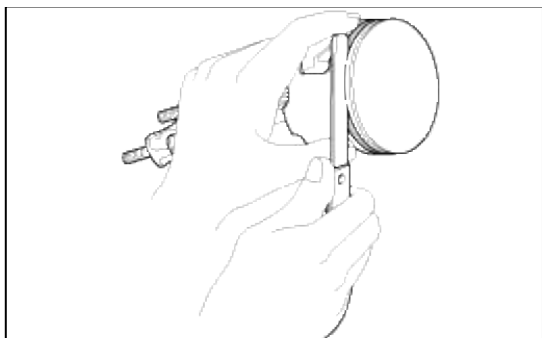
Oil ring : 0.06 ~ 0.15mm(0.0024 ~ 0.0059in)

Limit

No.1 : 0.1mm(0.004in)

No.2 : 0.1mm(0.004in)

Oil ring : 0.2mm(0.008in)



If the clearance is greater than maximum, replace the piston.

#### 5. Inspect piston ring end gap.

To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring. If the gap is too large, recheck the cylinder bore diameter against the wear limits. If the bore is over the service limit, the cylinder block must be replaced.

---

### Piston ring end gap

#### Standard

No.1 : 0.17 ~ 0.32mm(0.0067 ~ 0.0126in)

No.2 : 0.32 ~ 0.47mm(0.0126 ~ 0.0185in)

Oil ring : 0.20 ~ 0.70mm(0.0079 ~ 0.0275in)

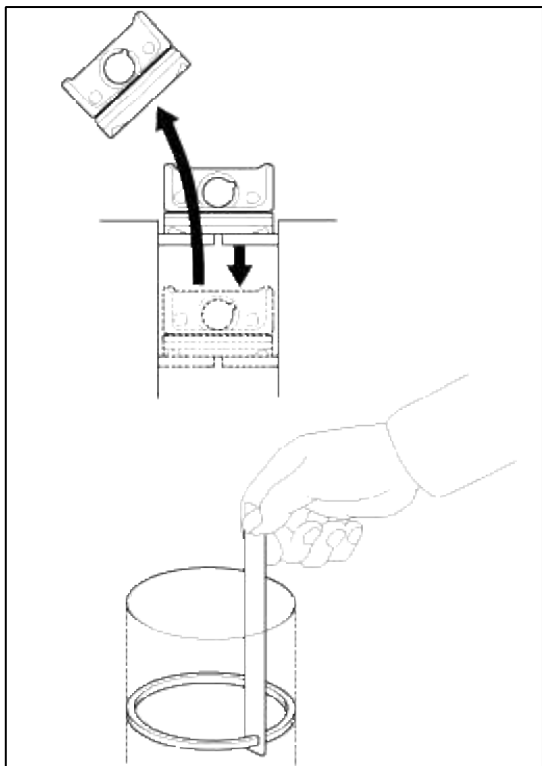
#### Limit

No.1 : 0.6mm(0.0236in)

No.2 : 0.7mm(0.0275in)

Oil ring : 0.8mm(0.0315in.)

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PISTON PINS

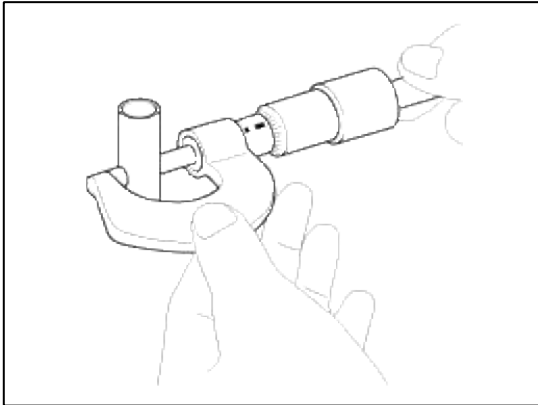
1. Measure the diameter of the piston pin.

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**Piston pin diameter**

23.001 ~ 23.006mm(0.9055 ~ 0.9057in)

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2. Measure the piston pin-to-piston clearance.

---

**Piston pin-to-piston clearance**

0.010 ~ 0.020mm(0.0004 ~ 0.0008in)

---

3. Check the difference between the piston pin diameter and the connecting rod small end diameter.

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**Piston pin-to-connecting rod interference**

-0.032 ~ -0.016mm(-0.0012 ~ -0.00063in)

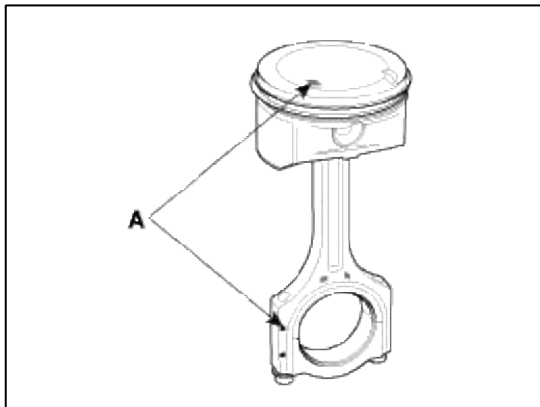
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## REASSEMBLY

### NOTE

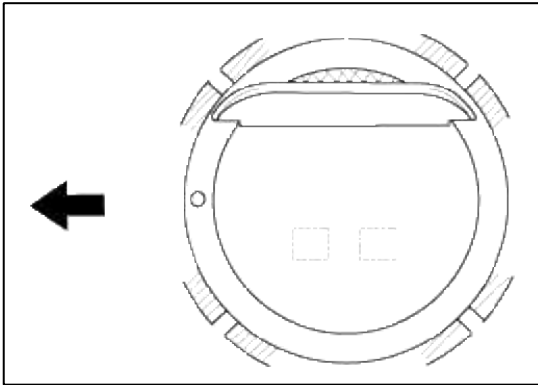
- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

1. Assemble piston and connecting rod.
  - (1) Use a hydraulic press for installation.
  - (2) The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



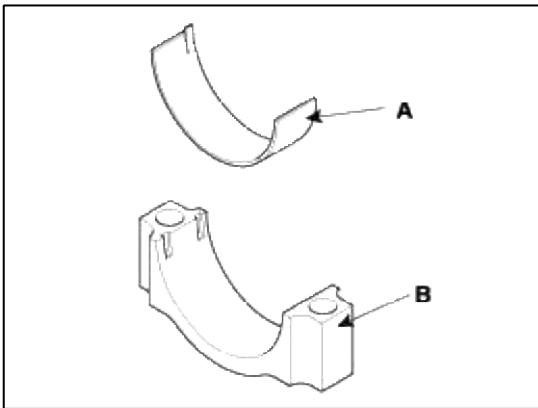
## 2. Install piston rings.

- (1) Install the oil ring spacer and 2 side rails by hand.
- (2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
- (3) Position the piston rings so that the ring ends are as shown.



## 3. Install connecting rod bearings.

- (1) Align the bearing claw with the groove of the connecting rod or connecting rod cap.
- (2) Install the bearings(A) in the connecting rod and connecting rod cap(B).

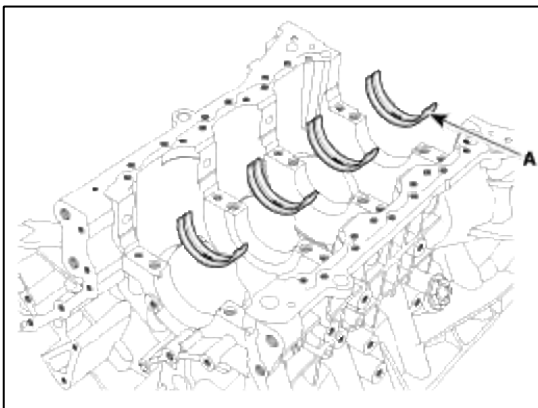


## 4. Install main bearings.

### NOTE

Upper bearings have an oil groove of oil holes; Lower bearings do not.

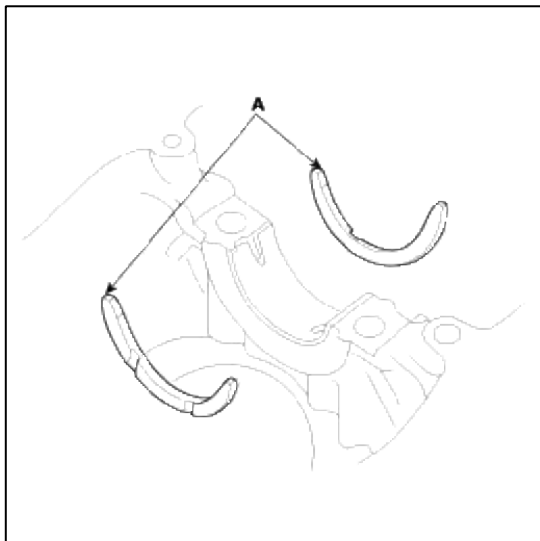
- (1) Align the bearing claw with the claw groove of the cylinder block, push in the 4 upper bearings(A).



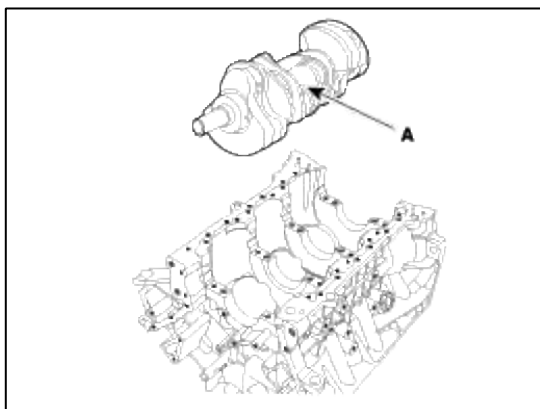
- (2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 4 lower bearings.

## 5. Install thrust bearings.

Install the 2 thrust bearings(A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.



## 6. Place crankshaft on the cylinder block.



## 7. Place main bearing caps on cylinder block.

## 8. Install main bearing cap bolts.

(1) Install and uniformly tighten the bearing cap bolts, in several passes, in the sequence shown.

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**Tightening torque**

Main bearing cap bolt

49.00Nm(5.0 kgf.m, 36.16lb-ft) + 90° (1 ~ 8)

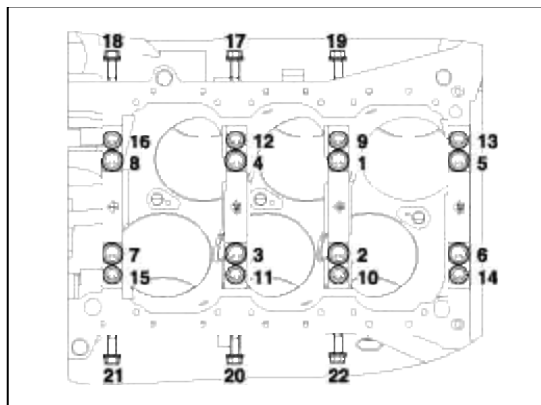
19.60 Nm(2.0 kgf.m, 14.46lb-ft)+ 120° (9 ~ 16)

29.40 ~ 31.36Nm(3.0 ~ 3.2 kgf.m, 21.70 ~ 23.14lb-ft) (17 ~ 22)

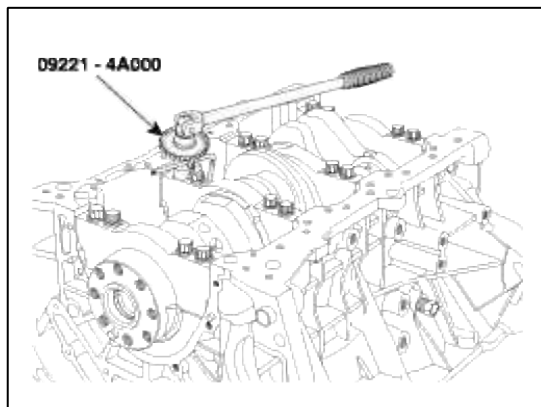
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**NOTE**

- Always use new main bearing cap bolt.
- If any of the bearing cap bolts in broken or deformed, replace it.



Use SST( 09221-4A000 ), install main bearing cap bolts.



(2) Check that the crankshaft turns smoothly.

9. Check crankshaft end play.

10. Install piston and connecting rod assemblies.

#### NOTE

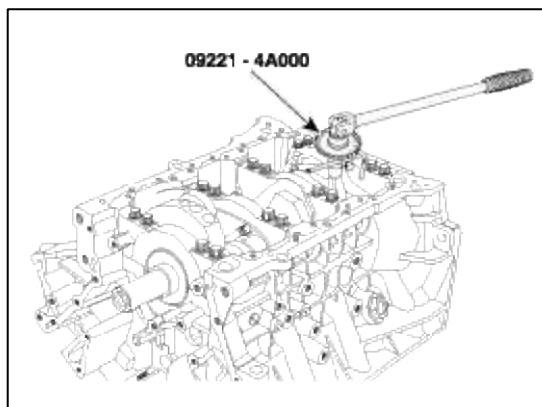
Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.

- (1) Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
- (2) Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.
- (3) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

#### Tightening torque

17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

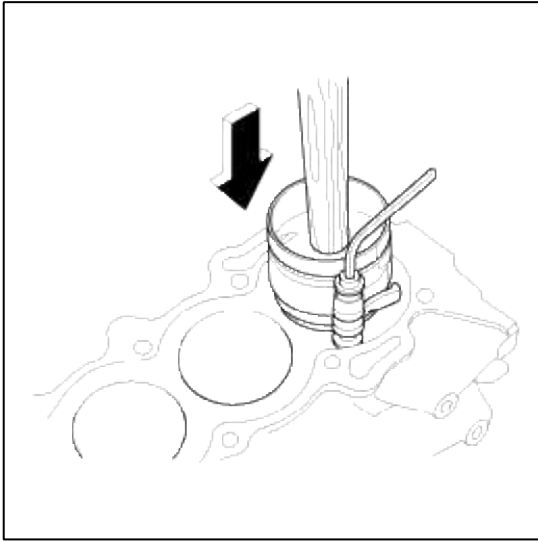
Use SST(09221-4A000), install connecting rod bearing cap bolts.





**NOTE**

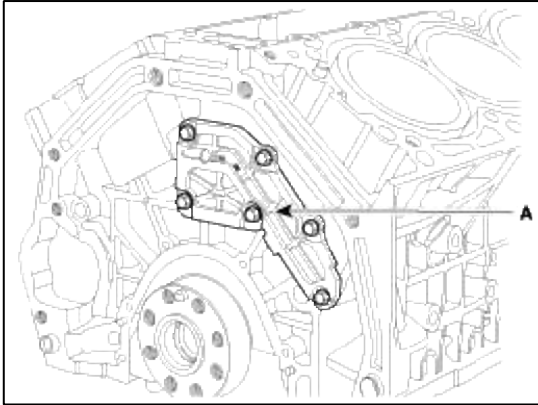
- Always use new connecting rod bearing cap bolt.
- Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.



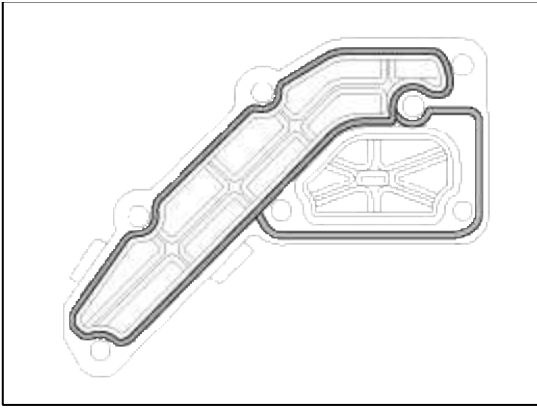
11. Check the connecting rod end play.
12. Install oil drain cover.

**Tightening torque**

9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lb-ft)

**NOTE**

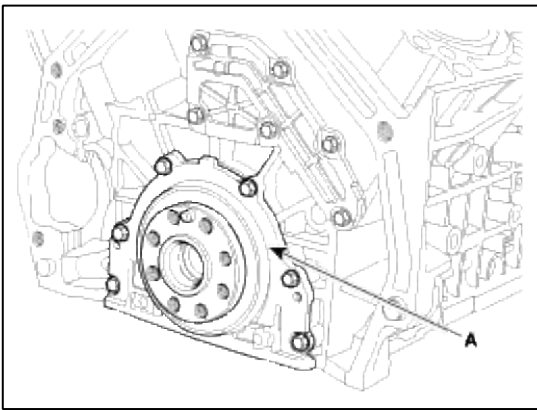
- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant
- Be assembling oil drain cover, the liquid sealant TB1217H should be applied oil drain cover.
- The part must be assembled within 5 minutes after sealant was applied.
- Apply sealant to the inner threads of the bolt holes.



13. Install rear oil seal case.

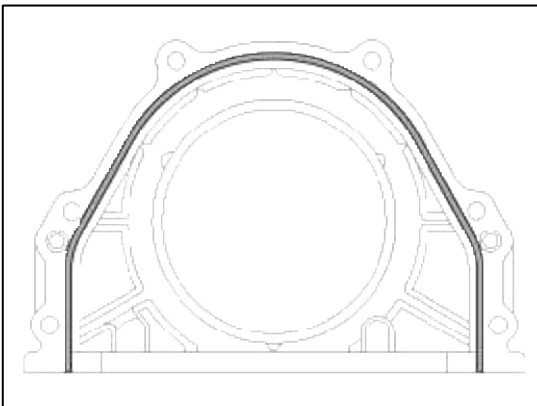
### Tightening torque

9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lb-ft)

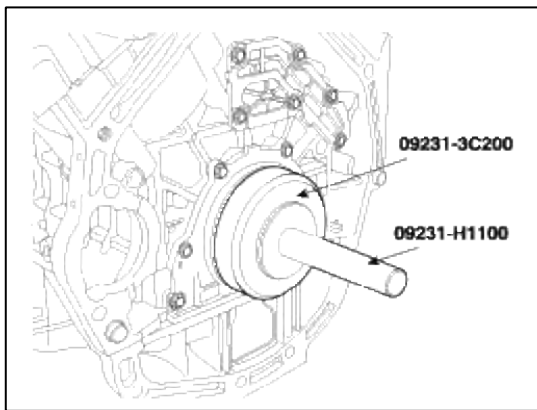


### NOTE

- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant
- Be assembling rear oil seal case, the liquid sealant TB1217H should be applied rear oil seal case.
- The part must be assembled within 5 minutes after sealant was applied.
- Apply sealant to the inner threads of the bolt holes.



14. Using SST(09231-3C200, 09231-H1100), install rear oil seal.

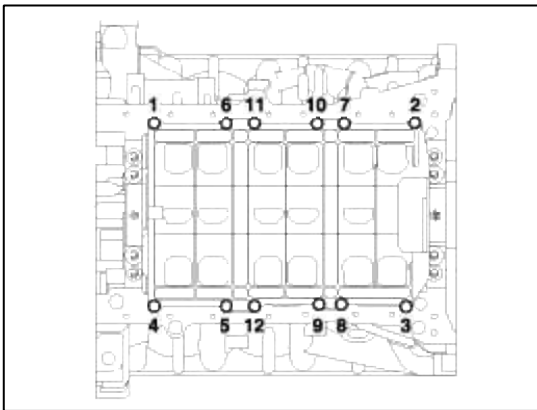


15. Install baffle plate.

Install and uniformly tighten the baffle plate bolts, in several passes, in the sequence shown.

### Tightening torque

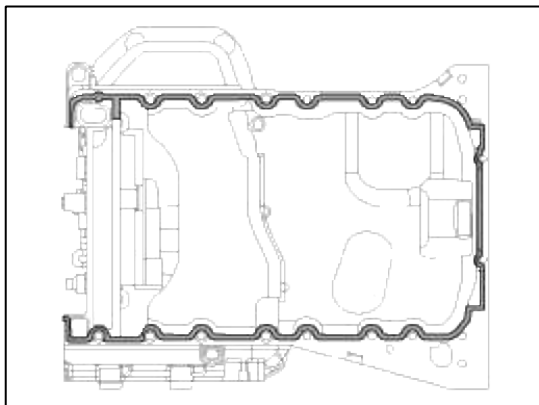
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



16. Install upper oil pan.

- A. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
- B. Before assembling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan.  
The part must be assembled within 5 minutes after the sealant was applied.

Bead width : 2.5mm(0.1in.)



**CAUTION**

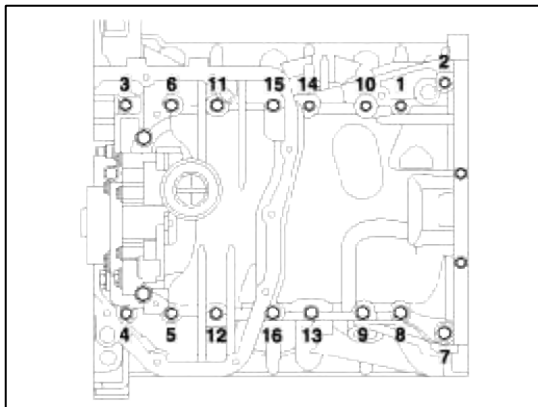
- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant
- When applying sealant gasket, sealant must not be protruded into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket of the inner threads of the bolt holes.

**C. Install oil pan.**

Uniformly tighten the bolts in several passes.

**Tightening torque**

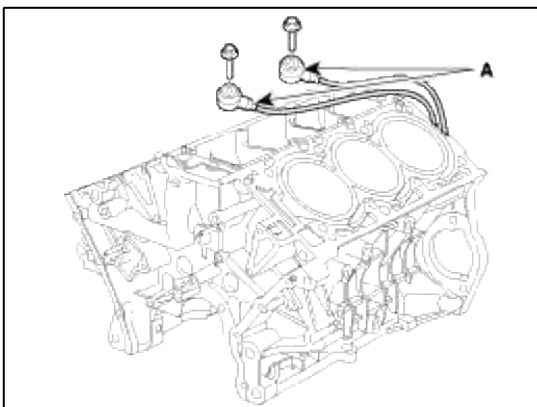
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



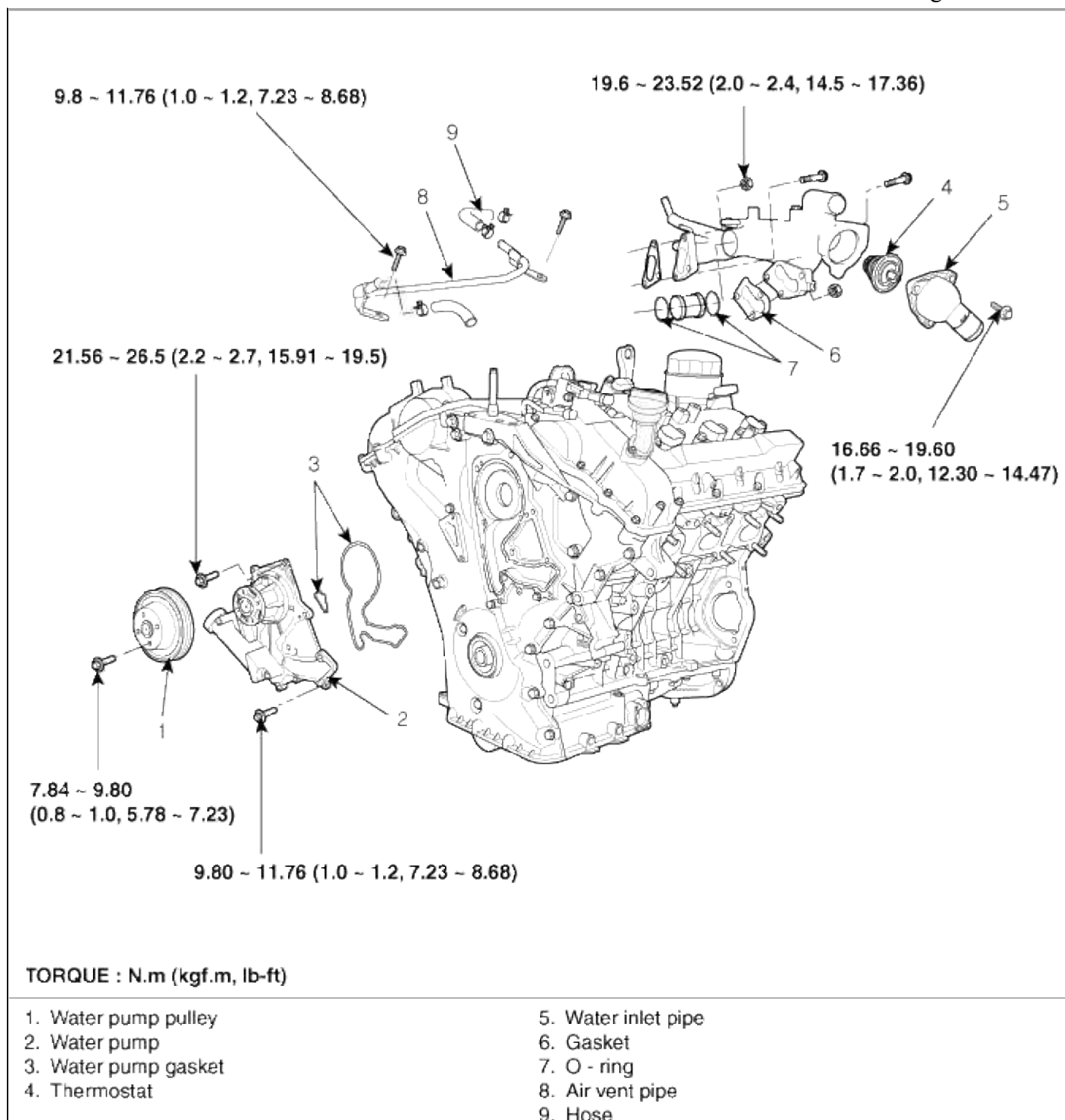
D. After assembly, wait at least 30 minutes before filling the engine with oil.

**17. Install knock sensor.****Tightening torque**

15.68 ~ 23.52Nm (1.6 ~ 2.4kgf.m, 11.57 ~ 17.36lb-ft)

**18. Install drive plate.****Tightening torque**

71.54 ~ 75.46Nm (7.3 ~ 7.7kgf.m, 52.80 ~ 55.69lb-ft)



## Engine Mechanical System > Cooling System > Repair procedures

### REMOVAL

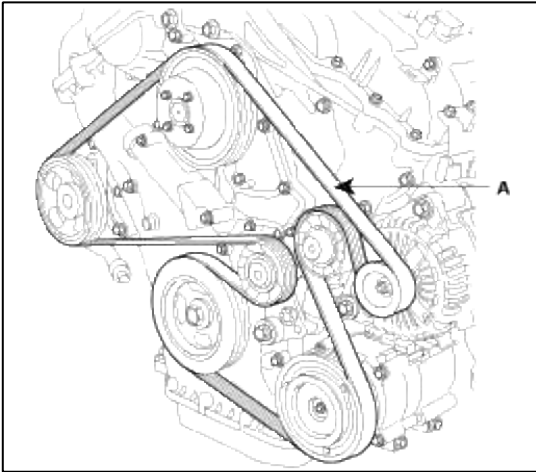
### WATER PUMP

1. Drain the engine coolant.

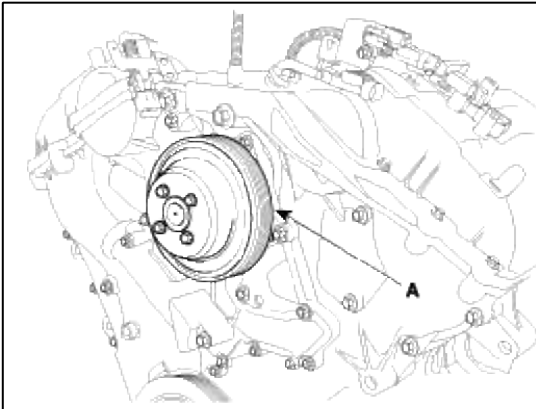
#### **WARNING**

System is under high pressure when the engine is hot. To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

2. Remove drive belt(A).

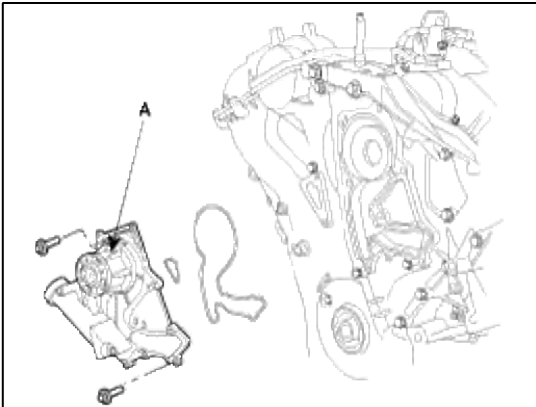


3. Remove the 4 bolts and pump pulley(A).



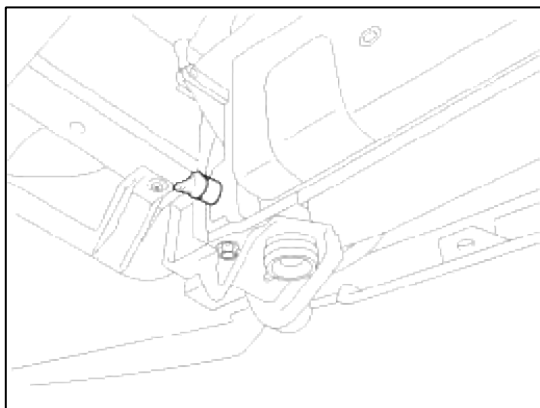
4. Remove the cooling fan shroud.

5. Remove the water pump(A) and gasket.



RADIATOR

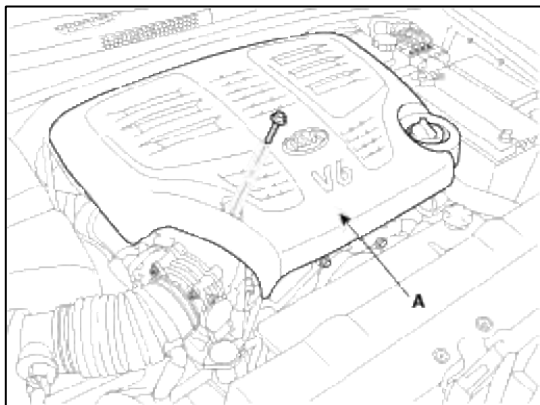
1. Drain engine coolant.



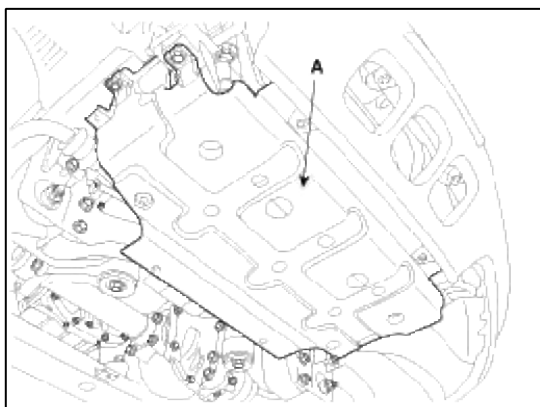
**WARNING**

System is under high pressure when the engine is hot. To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

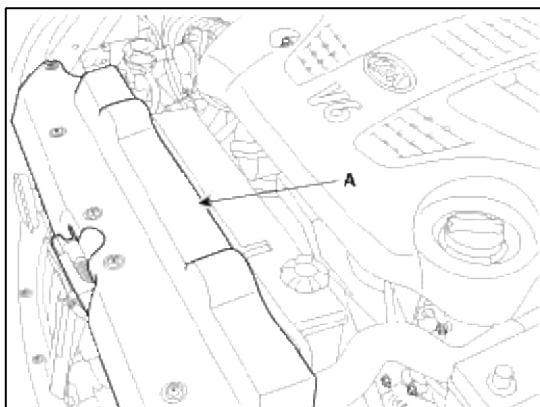
2. Remove the engine cover(A).



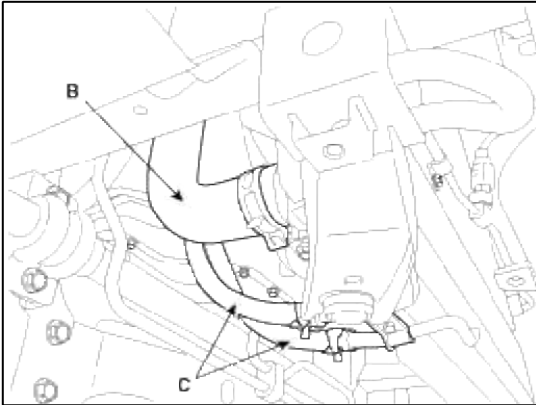
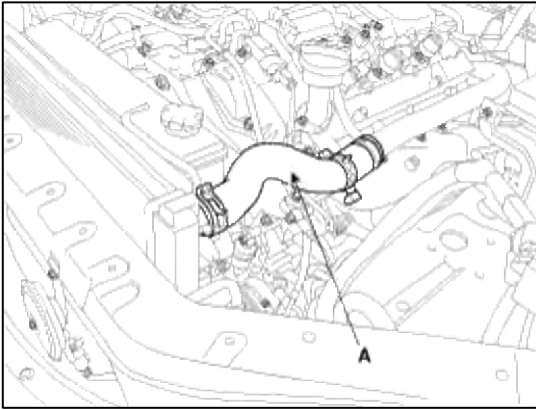
3. Remove the under cover(A).



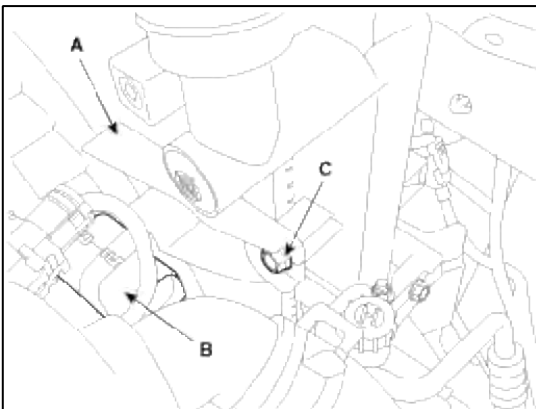
4. Remove the radiator grille upper cover(A).



5. Disconnect the radiator upper hose(A) and lower hose(B) and the automatic transaxle fluid cooler hoses(C).



6. Remove the radiator from the condensor by removing bolts.(Refer to Condensor in HA Group).
7. Remove the cooling fan shroud(A) after disconnecting cooling fan harness connector(B) and loosening the mounting bolts(C).



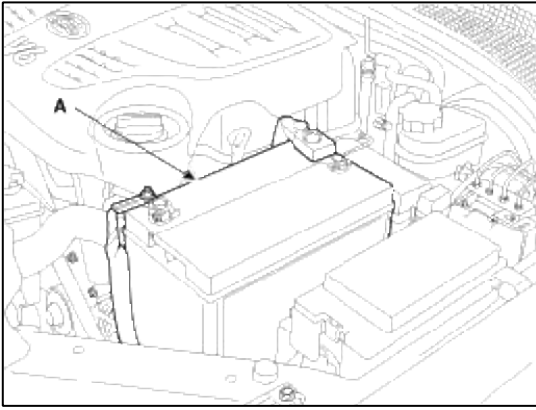
8. Remove the radiator assembly.

#### WATER TEMPERATURE CONTROL ASSEMBLY

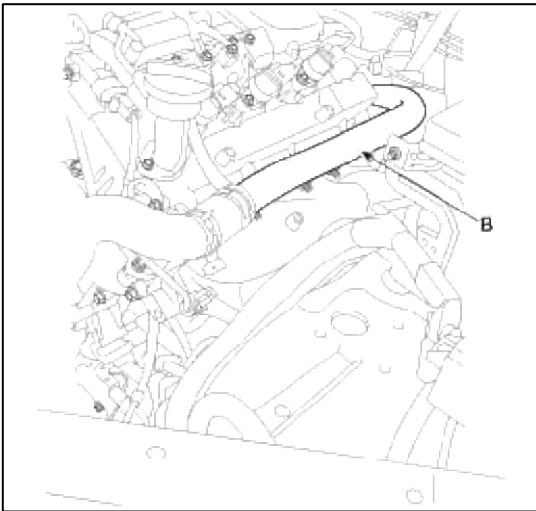
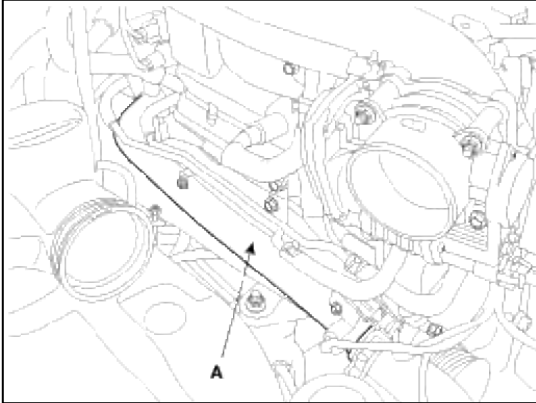
1. Drain the engine coolant.
2. Remove air cleaner assembly.
3. Remove the automatic transaxle oil gauge.



4. Remove the battery assembly(A).



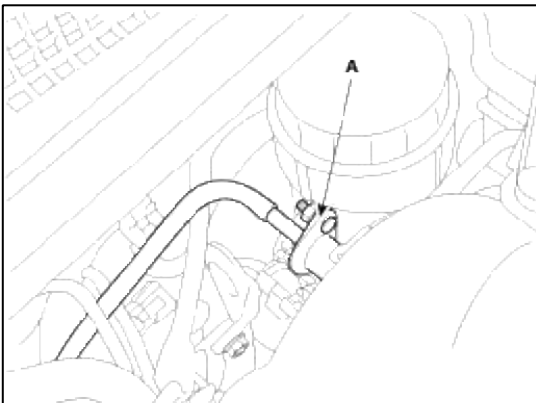
5. Disconnect the RH/LH cooling pipes(A, B).



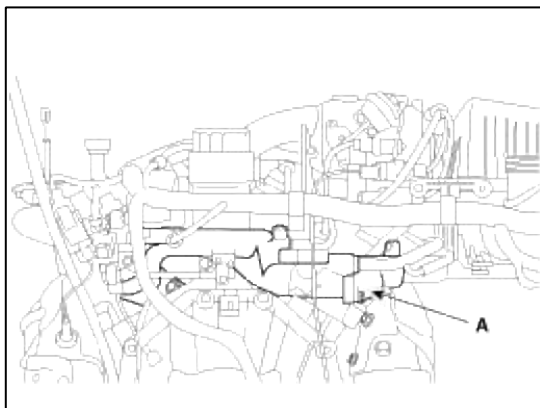
6. Disconnect WTS connector.

7. Disconnect heater hose, water vent hose and water hose from water temperature control assembly.

8. Remove the fuel pipe(A).



## 9. Remove water temperature control assembly(A).

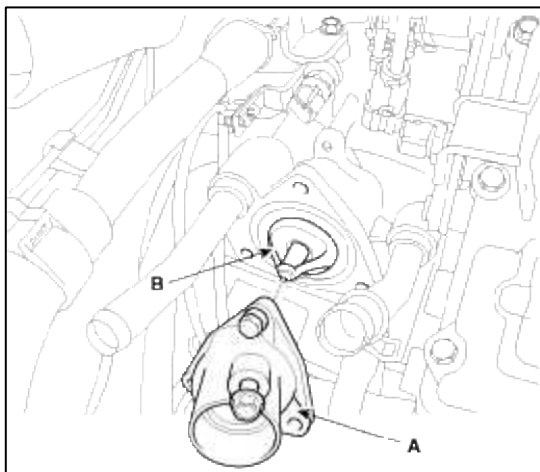


## THERMOSTAT

**NOTE**

Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet(A) and thermostat(B).



## INSTALLATION

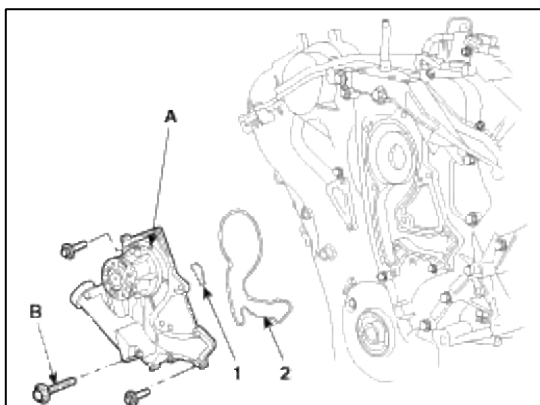
**WATER PUMP**

1. Install the water pump(A) and a new gasket(1, 2) with 12 bolts.

**Tightening torque**

21.56 ~ 23.52Nm (2.2 ~ 2.4kgf.m, 15.91 ~ 17.36lb-ft)

9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



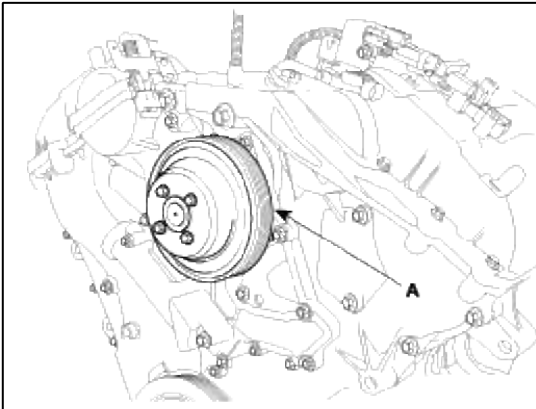
**NOTE**

- Make clean the contact face before assembly.
- When replacing a water pump, always use new gasket(1, 2).
- When reassembling a water pump, replace the bolt(B) with a new one.

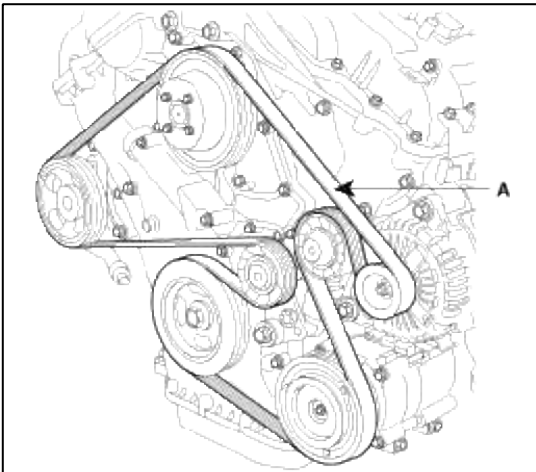
2. Install the 4 bolts and pump pulley(A).

**Tightening torque**

7.84 ~ 9.80Nm (0.8 ~ 1.0kgf.m, 5.78 ~ 7.23lb-ft)



3. Install drive belt(A).



4. Fill with engine coolant.

5. Start engine and check for leaks.

6. Recheck engine coolant level.

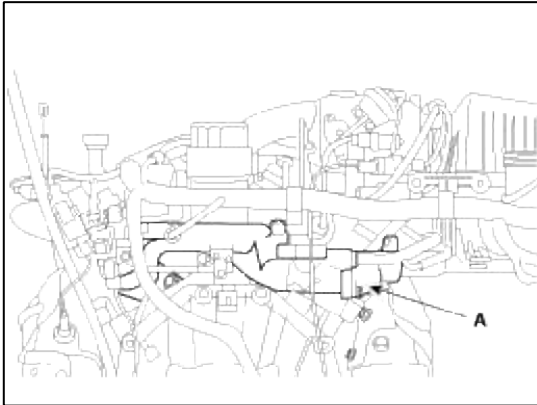
**WATER TEMPERATURE CONTROL ASSEMBLY****NOTE**

Make clean the contact face before assembly.

1. Install water temperature control assembly(A) and new gasket.

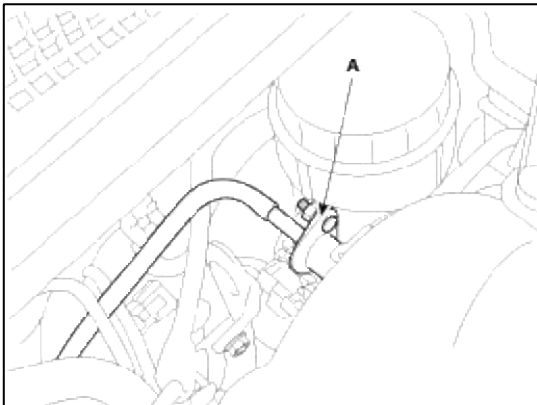
**Tightening torque**

19.6 ~ 23.52Nm (2.0 ~ 2.4kgf.m, 14.5 ~ 17.36lb-ft)

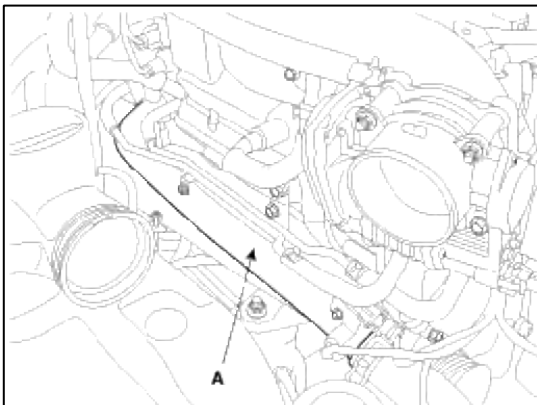
**NOTE**

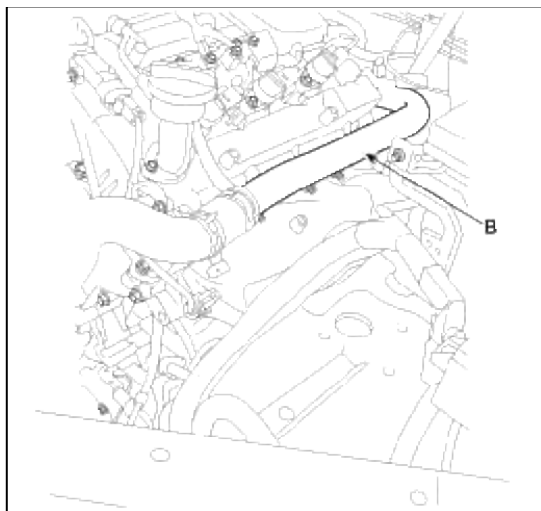
Use new O-rings(C) when reassembling.

2. Connect water hoses to the water temperature control assembly.
3. Install the fuel pipe(A).

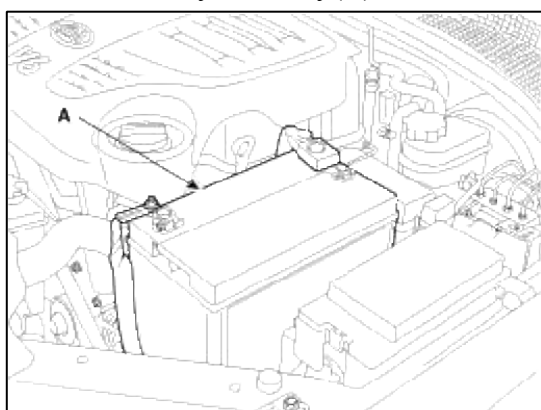


4. Connect WTS connector.
5. Connect the RH/LH cooling pipes(A, B).





6. Install the battery assembly(A).



7. Install the automatic transaxle oil gauge.

8. Install air cleaner assembly.

9. Fill with engine coolant.

10. Start engine and check for leaks.

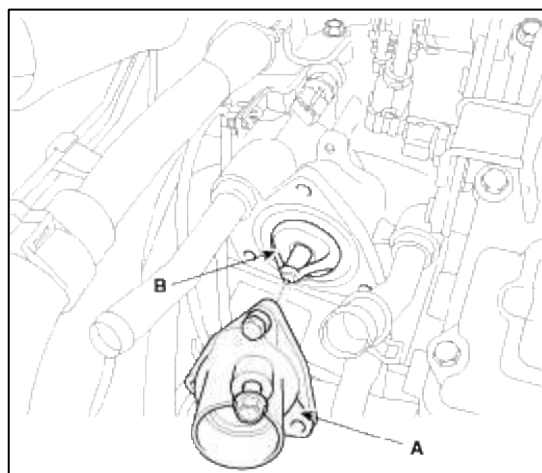
11. Recheck engine coolant level.

#### THERMOSTAT

1. Place thermostat in thermostat housing.

(1) Install the thermostat with the jiggle valve upward.

(2) Install a new thermostat(B).



2. Install water inlet(A).

---

#### Tightening torque

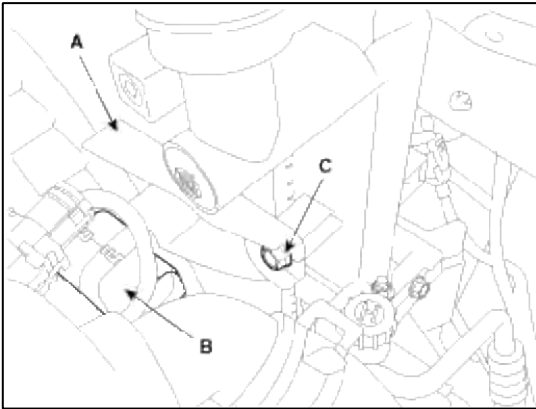
16.66 ~ 19.60Nm (1.7 ~ 2.0kgf.m, 12.30 ~ 14.47lb-ft)

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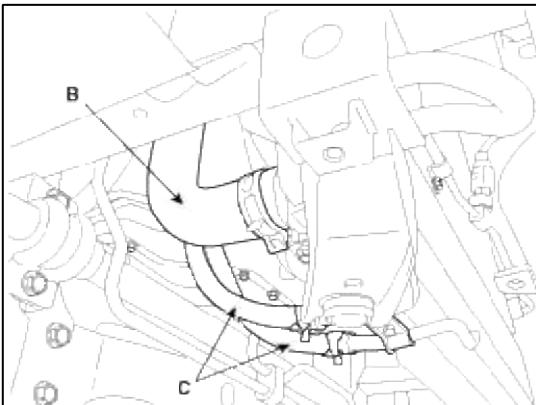
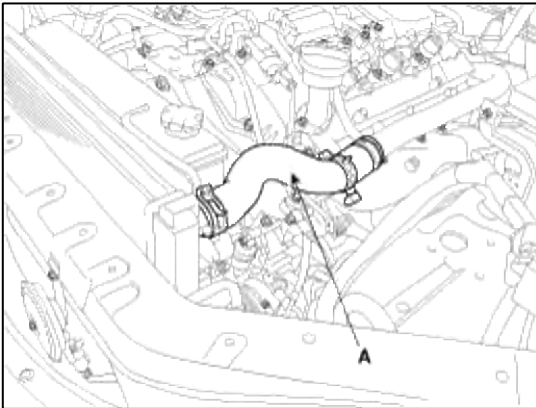
3. Fill with engine coolant.
4. Start engine and check for leaks.

## RADIATOR

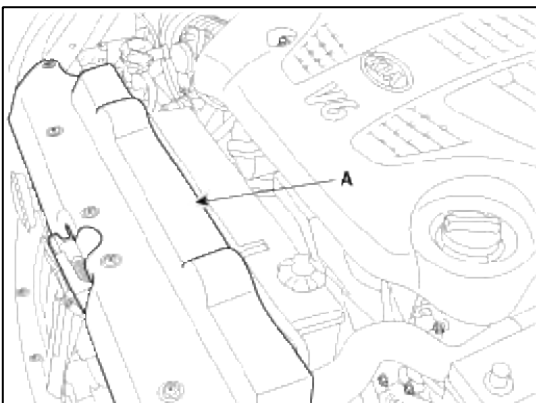
1. Install the radiator assembly.
2. Install the cooling fan shroud(A) by connecting cooling fan harness connector(B) and tightening the mounting bolts(C).



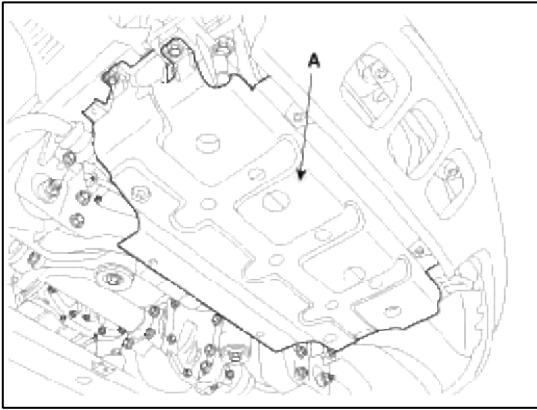
3. Install the radiator with the condensor by tightening bolts.(Refer to Condensor in HA Group).
4. Connect the radiator upper hose(A) and lower hose(B) and the automatic transaxle fluid cooler hoses(C).



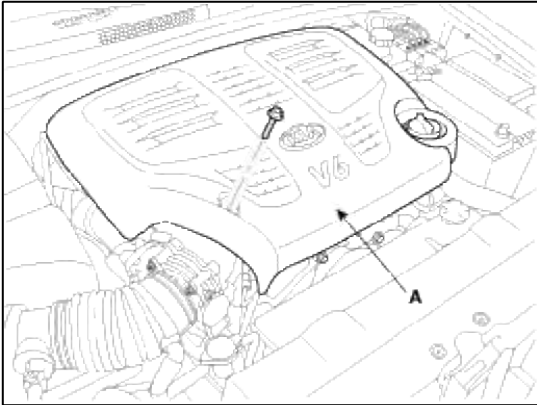
5. Install the radiator grille upper cover(A).



6. Install the under cover(A).



7. Install the engine cover(A).



8. Refill engine coolant.

## INSPECTION

### WATER PUMP

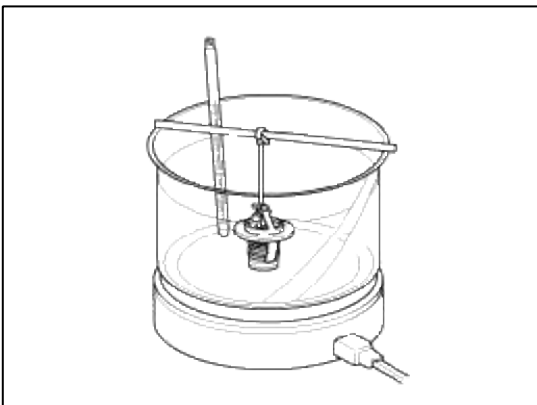
1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

#### NOTE

A small amount of "weeping" from the bleed hole is normal.

## THERMOSTAT

1. Immerse the thermostat in water and gradually heat the water.



2. Check the valve opening temperature.  
 Valve opening temperature : 82°C (177°F)  
 Full opening temperature : 95°C (205°F)  
 If the valve opening temperature is not as specified, replace the thermostat.
3. Check the valve lift.  
 Valve lift : Min. 10mm (0.4in.) at 95°C (205°F)  
 If the valve lift is not as specified, replace the thermostat.

## INSPECTION

### WATER PUMP

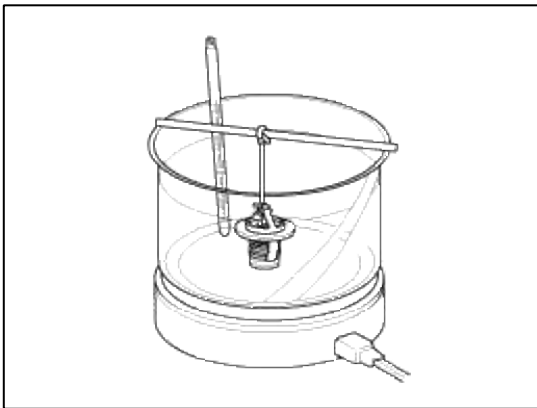
1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

#### NOTE

A small amount of "weeping" from the bleed hole is normal.

### THERMOSTAT

1. Immerse the thermostat in water and gradually heat the water.

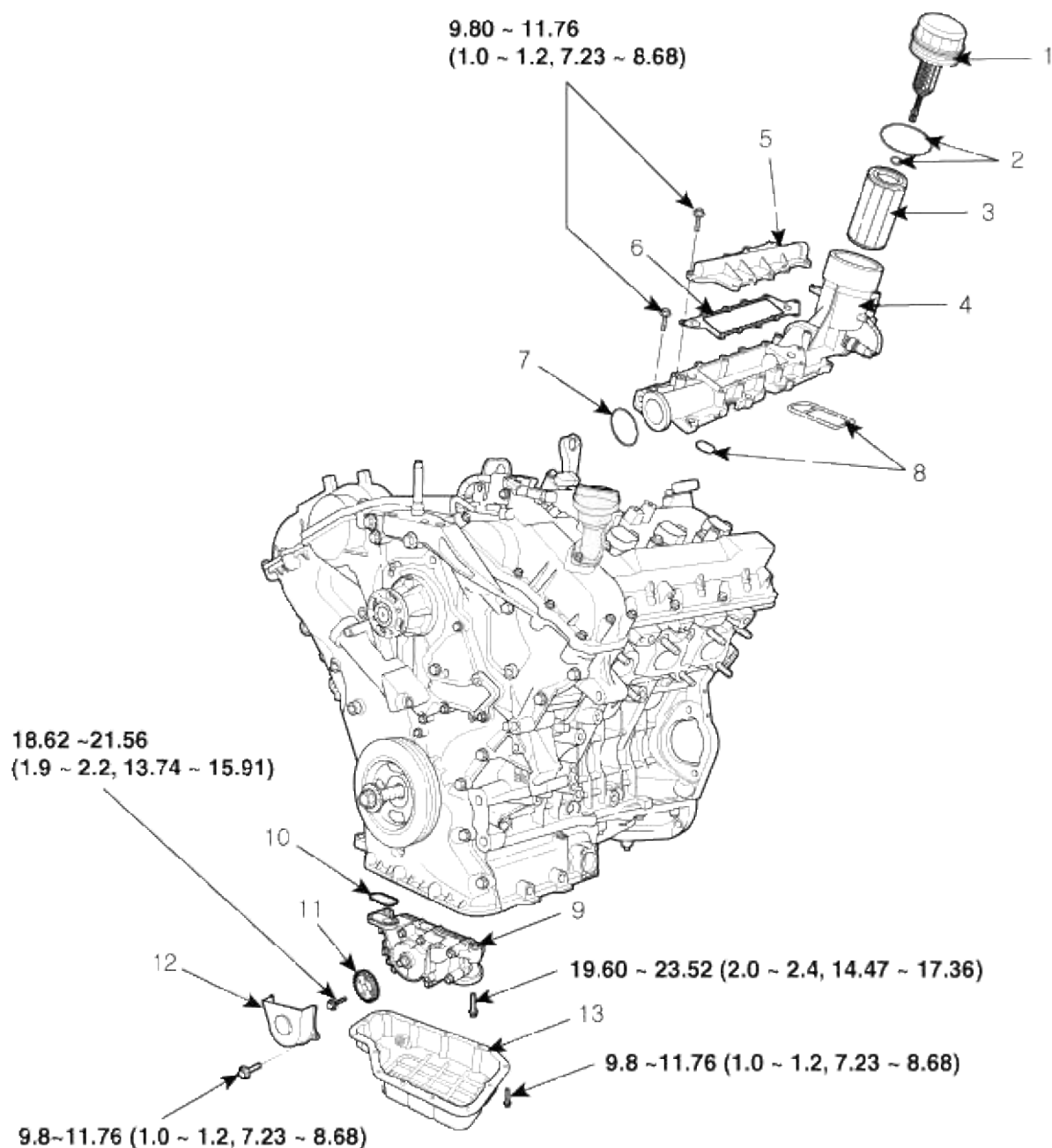


2. Check the valve opening temperature.  
 Valve opening temperature : 82°C (177°F)  
 Full opening temperature : 95°C (205°F)  
 If the valve opening temperature is not as specified, replace the thermostat.
3. Check the valve lift.  
 Valve lift : Min. 10mm (0.4in.) at 95°C (205°F)  
 If the valve lift is not as specified, replace the thermostat.

## Engine Mechanical System > Lubrication System > Components and Components Location

### COMPONENTS





TORQUE : N.m (kgf.m, lbf.ft)

- |                          |             |                          |
|--------------------------|-------------|--------------------------|
| 1. Oil filter cap        | 6. Gasket   | 11. Oil pump sprocket    |
| 2. O - ring              | 7. O - ring | 12. Oil pump chain cover |
| 3. Oil filter element    | 8. Gasket   | 13. Lower oil paon       |
| 4. Oil filter body       | 9. Oil pump |                          |
| 5. Oil filter body cover | 10. Gasket  |                          |

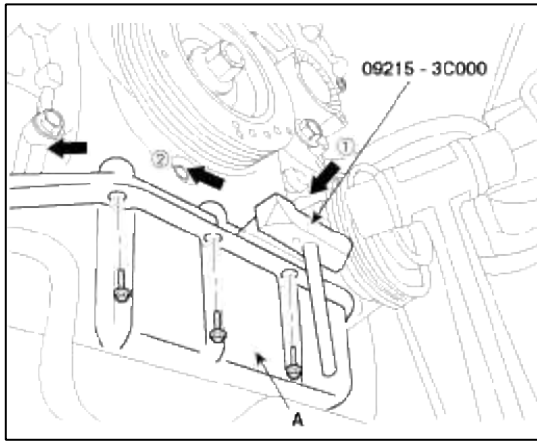
## Engine Mechanical System > Lubrication System > Repair procedures

### REMOVAL

#### Oil pump

1. Drain engine oil.
2. Remove the front member.(Refer to Front suspension system in SS Group).

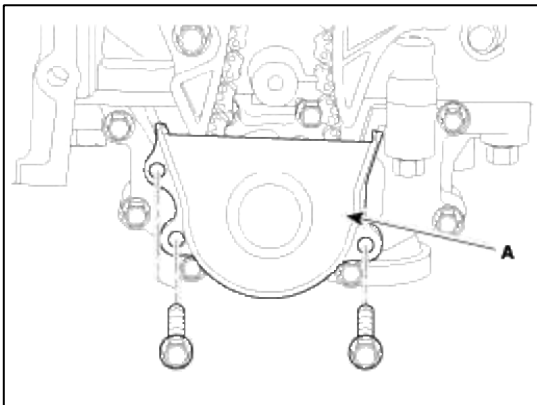
3. Using SST(09215-3C000) remove lower oil pan(A).



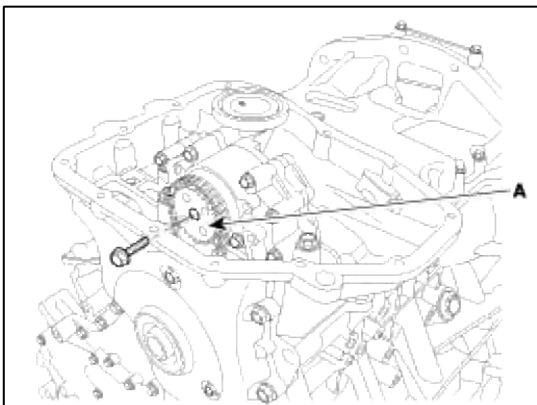
**CAUTION**

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It can result in damage of the SST.

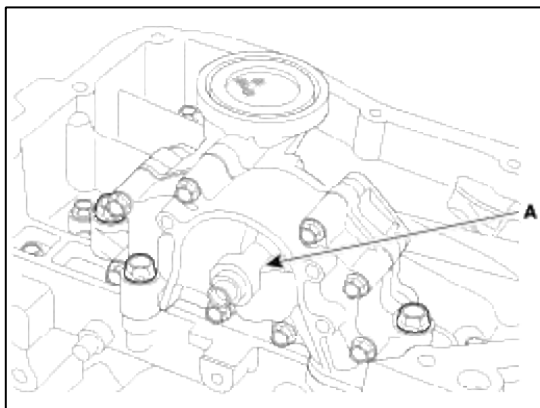
4. Remove oil pump chain cover(A).



5. Remove oil pump chain sprocket(A).

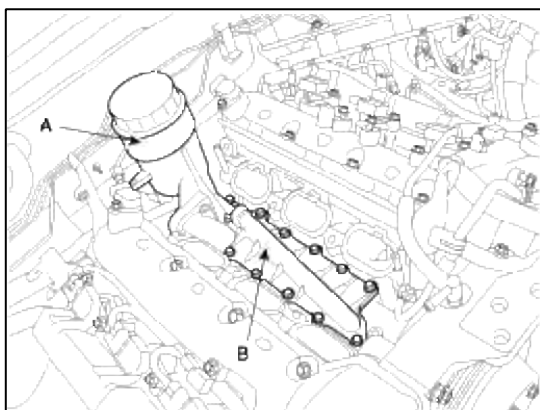


## 6. Remove oil pump(A).



## Oil filter assembly

1. Remove the engine assembly.(Refer to Engine and transaxle assembly in this Group).
2. Loosen the oil filter cap by turning it counterclockwise to drain well the oil in the oil filter.
3. Remove surge tank and intake manifold.
4. Disconnect oil pressure switch connector.
5. Drain engine coolant.
6. Disconnect water hoses from water temperature control assembly.
7. Remove water temperature control assembly.
8. Remove oil filter body cover(B).
9. Remove oil filter body(A).



## ENGINE OIL

1. Check engine oil quality.  
Check the oil for deterioration, entry of water, discoloring or thinning.  
If the quality is visibly poor, replace the oil.
2. Check engine oil level.  
After warming up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks on the dipstick.  
If low, check for leakage and add oil up to the "F" mark.

**NOTE**

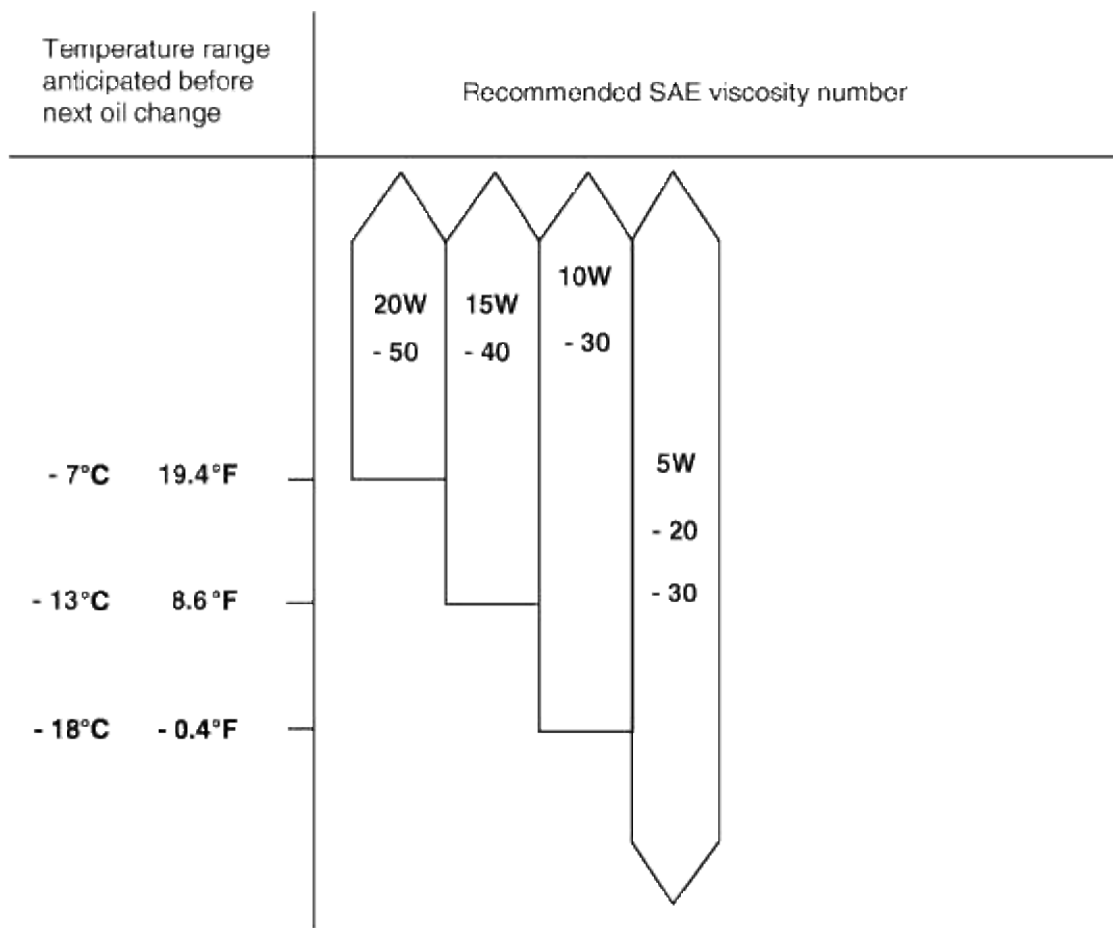
Do not fill with engine oil above the "F" mark.

## SELECTION OF ENGINE OIL

Recommended API classification : Above SJ or SL

Recommended SAE viscosity grades : 5W-20

If 5W-20 engine oil is not available, 5W-30 or secondary recommended engine oil for corresponding temperature range can be used.

**NOTE**

For best performance and maximum protection of all types of operation, select only those lubricants which :

- Satisfy the requirement of the API classification.
- Have proper SAE grade number for expected ambient temperature range.

Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

**INSTALLATION****Oil pump**

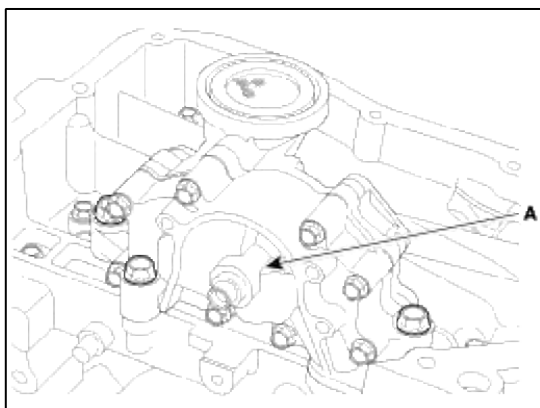
### 1. Install oil pump(A).

**Tightening torque**

19.60 ~ 23.52Nm (2.0 ~ 2.4kgf.m, 14.47 ~ 17.36lb-ft)

**NOTE**

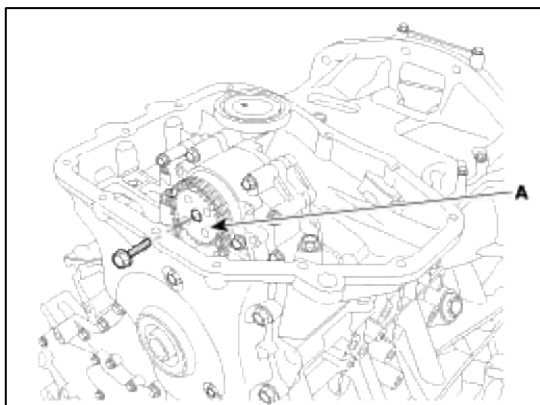
Always use a new O-ring.



### 2. Install oil pump sprocket(A) and oil pump chain on the oil pump.

**Tightening torque**

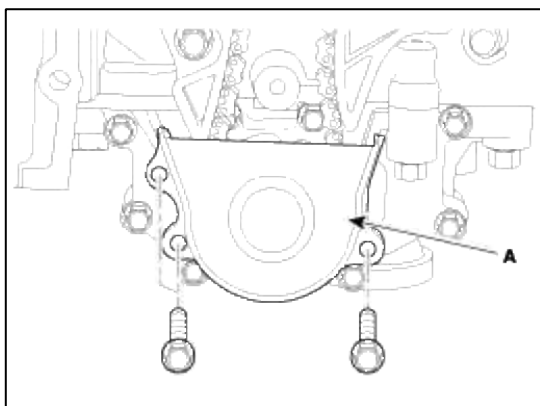
18.62 ~ 21.56Nm (1.9 ~ 2.2kgf.m, 13.74 ~ 15.91lb-ft)



### 3. Install oil pump chain cover(A).

**Tightening torque**

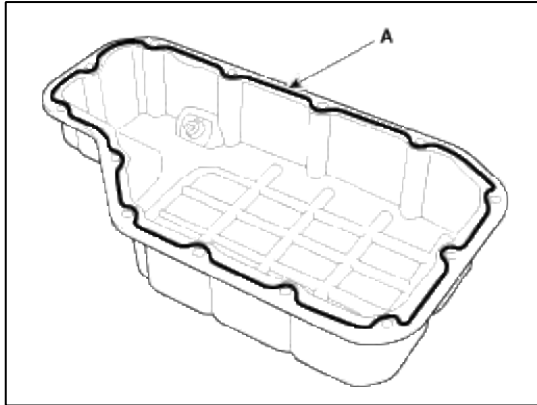
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



#### 4. Install upper oil pan.

- A. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
- B. Before assembling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan.  
The part must be assembled within 5 minutes after the sealant was applied.

Bead width : 2.5mm(0.1in.)



#### CAUTION

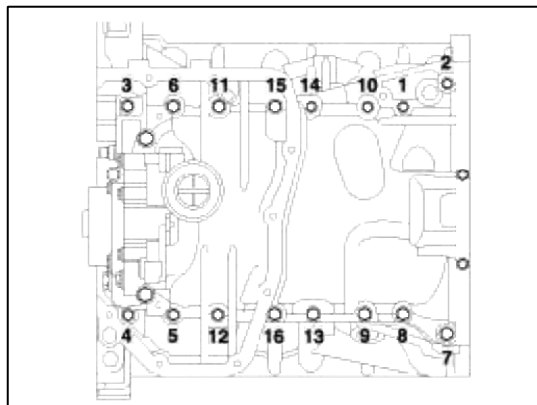
- Make clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant
- When applying sealant gasket, sealant must not be protruded into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket of the inner threads of the bolt holes.

#### C. Install upper oil pan.

Uniformly tighten the bolts in several passes.

#### Tightening torque

9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)



#### D. Install the front member.(Refer to Front suspension system in SS Group).

- E. After assembly, wait at least 30 minutes before filling the engine with oil.

#### OIL FILTER ASSEMBLY

1. Install oil filter body and new O-rings.

### Tightening torque

9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

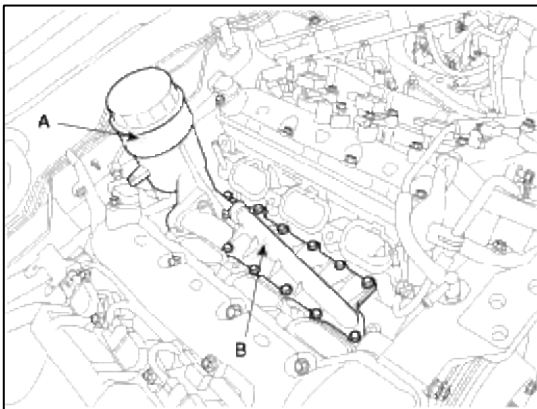
#### NOTE

- All rubber gasket must be no damaged by assembling parts.
- Be careful of the knock sensor connector.
- Always use a new O-ring

2. Install oil filter body cover(B) and new gasket on the oil filter body(A).

### Tightening torque

9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

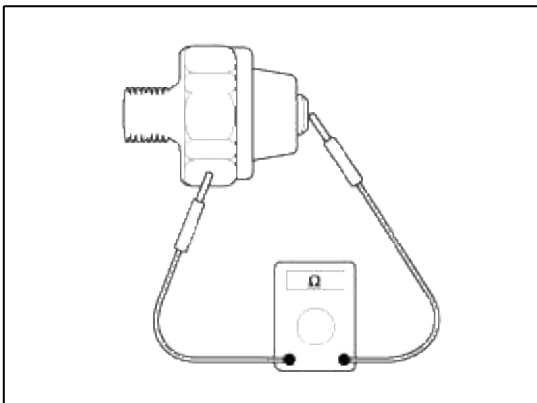


3. Install the water temperature control assembly.
4. Connect the water hoses on the water temperature control assembly.
5. Connect the oil pressure switch connector.
6. Install the intake manifold and surge tank.
7. Fill with engine coolant.
8. Start engine and check for leaks.
9. Recheck engine coolant level.

## INSPECTION

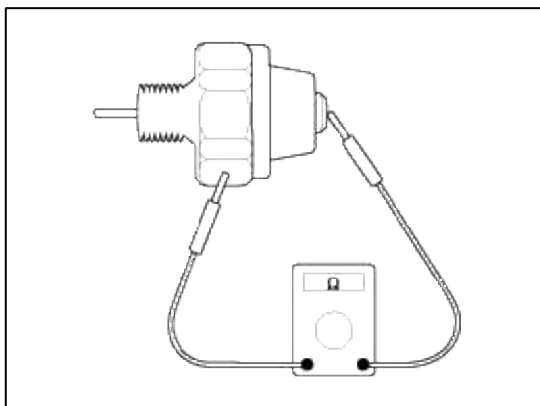
### OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.  
If there is no continuity, replace the oil pressure switch.



2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly.

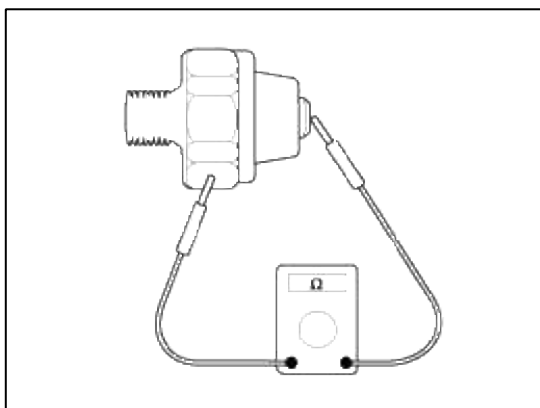
Check for air leakage. If air leaks, the diaphragm is broken. Replace it.



## INSPECTION

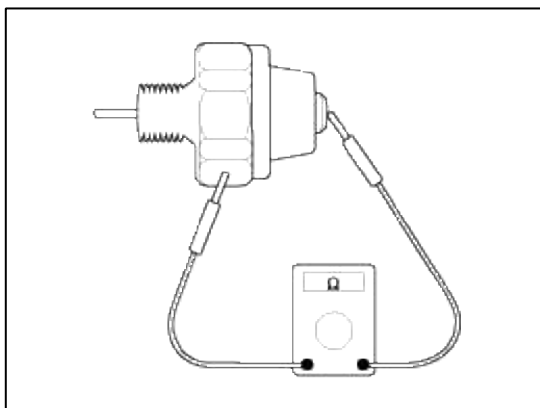
### OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.  
If there is no continuity, replace the oil pressure switch.



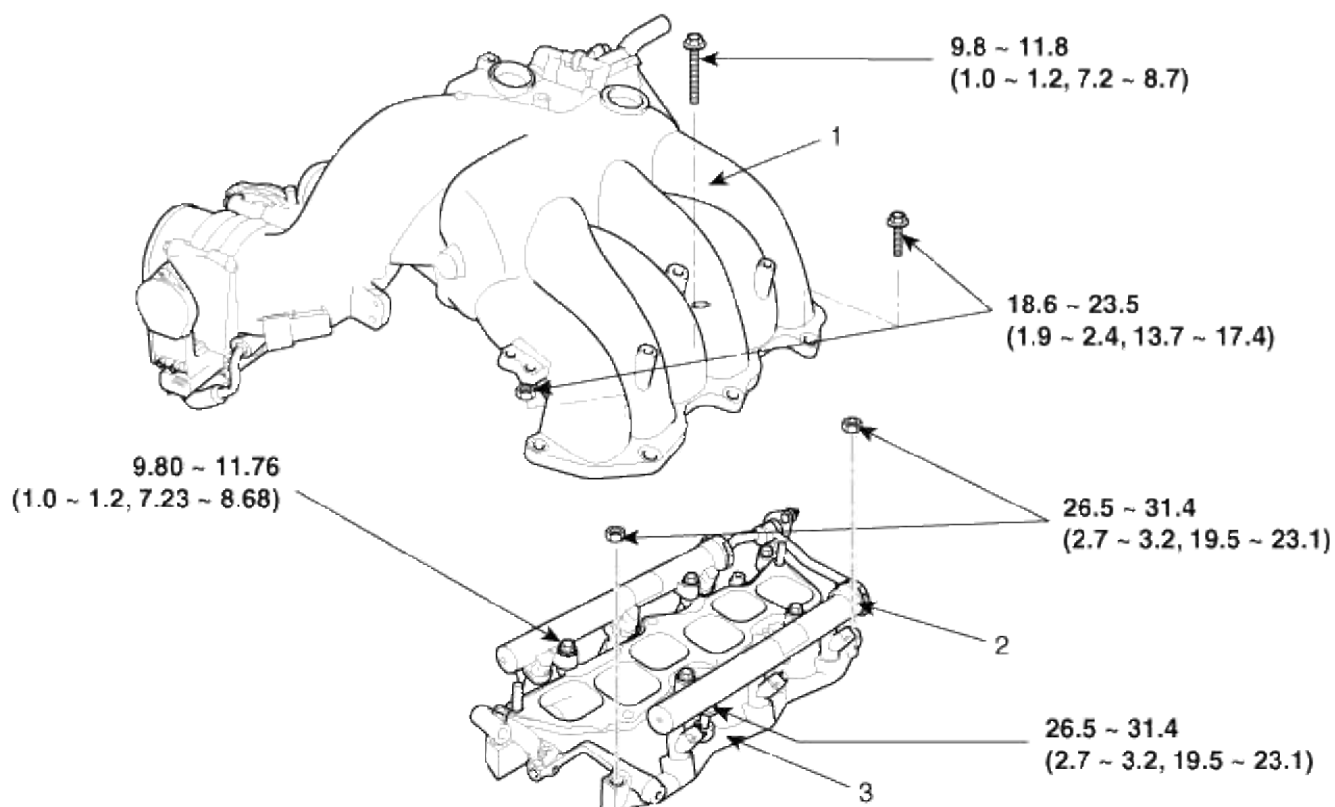
2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly.

Check for air leakage. If air leaks, the diaphragm is broken. Replace it.





## COMPONENTS



**TORQUE : N.m (kgf.m, lbf.ft)**

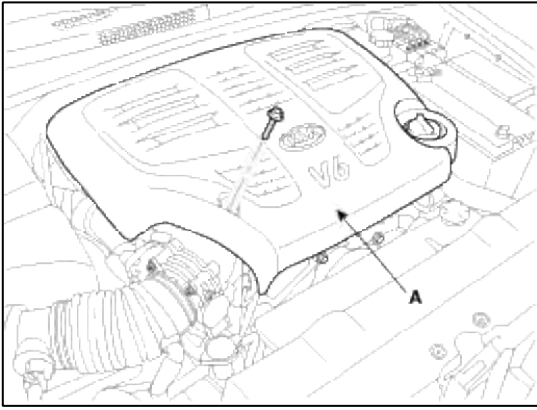
- 1. Surge tank
- 2. Delivery pipe
- 3. Intake manifold

- 4. Surge tank gasket
- 5. Intake manifold gasket

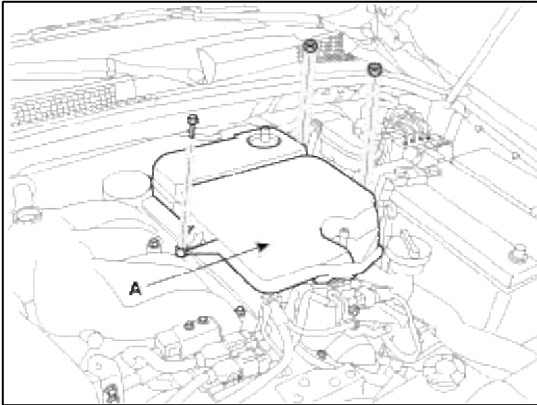
**Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Repair procedures**

## REPLACEMENT

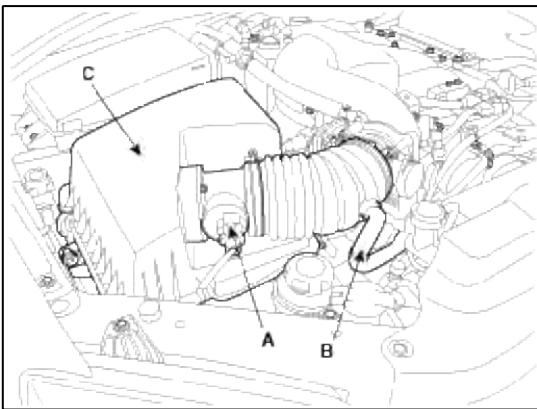
1. Remove the engine cover.



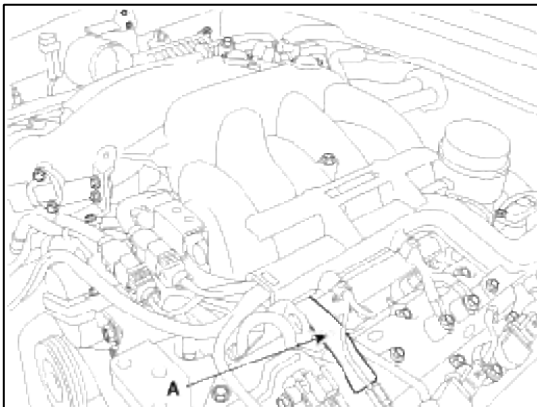
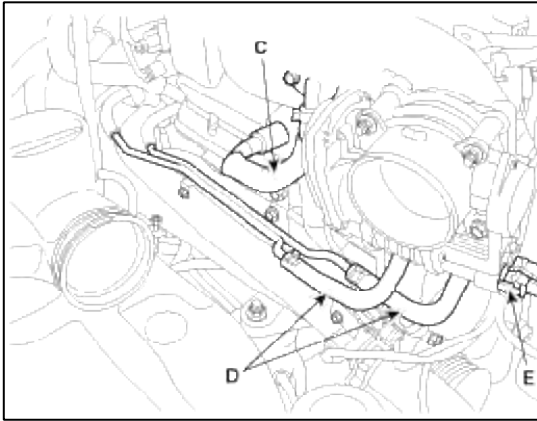
2. Remove the engine room resonator(A).



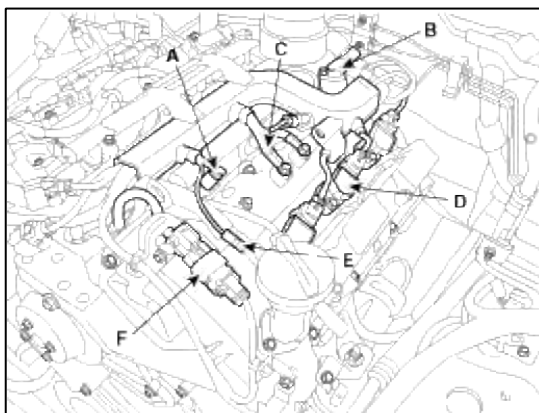
3. After disconnecting the MAF sensor connector(A) and the breather hose(B), remove the air cleaner assembly(C).

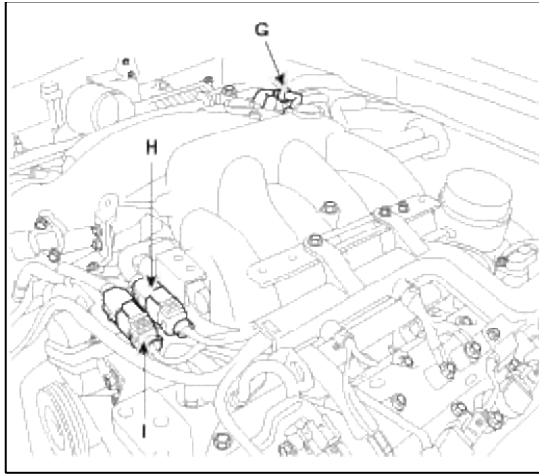


4. Disconnect the other breather hose(A), the Purge Control Solenoid Valve(PCSV) hose, the Positive Crankcase Ventilation (PCV) hose(C) and the Electronic Throttle Control(ETC) cooling hoses(D) and connector(E).

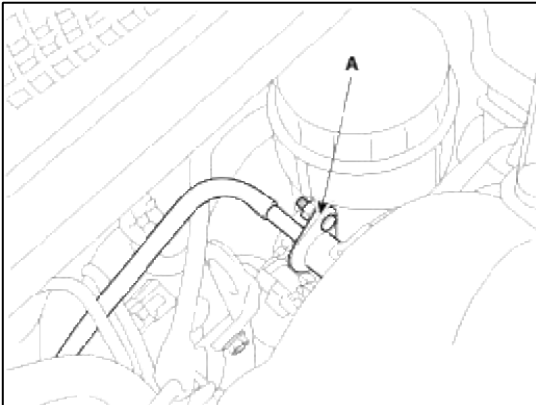


5. Remove the wiring over the surge tank.
- (1) Disconnect the injection harness connector(A).
  - (2) Disconnect the camshaft position sensor(CMP) harness connector(B).
  - (3) Disconnect the ground line(C).
  - (4) Disconnect the ignition coil harness connector(D).
  - (5) Disconnect the condensor connector(E).
  - (6) Disconnect the variable induction system(VIS) solenoid valve connector(G).
  - (7) Disconnect the oil control valve(OCV) harness connector(F).
  - (8) Disconnect the injector wiring(H) and ignition coil wiring(I).

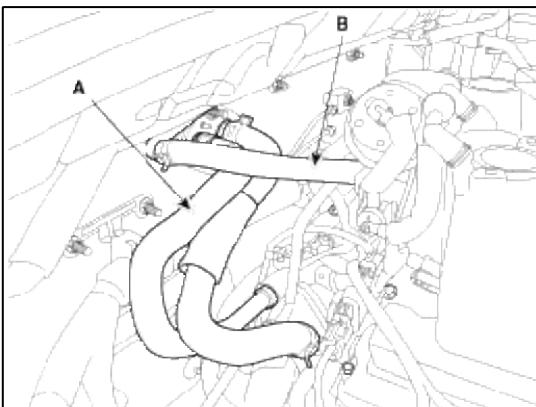




6. Disconnect the fuel hose tube(A).



7. Remove heater hose(A) and disconnect the brake vacuum hose(B).



8. Disconnect the surge tank stay.

9. Remove the surge tank.

10. Disconnect the injector connectors.

11. Disconnect the water hose on intake manifold from the nipple on the chain cover.

12. Remove the delivery pipe and intake manifold as an assembly.

#### NOTE

Except such cases as defects of injectors or pipe, do not disassemble a delivery pipe from an intake manifold because it is one of the fuel system parts, or you may have some problem in fuel system.

13. Install intake manifold and new gasket on the cylinder head.

### Tightening torque

1st : 3.9 ~ 5.9Nm (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lb-ft)

2nd

Bolt : 26.5 ~ 31.4Nm (2.7 ~ 3.2kgf.m, 19.5 ~ 23.1lb-ft)

Nut : 18.6 ~ 23.5Nm (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)

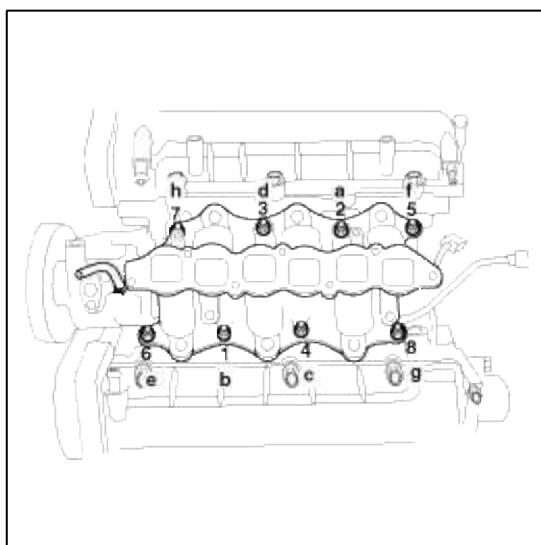
3rd : Repeat 2nd step twice or move.

### NOTE

Be careful of the installation direction.

a - h : 1st step order

1 ~ 8 : 2nd step order



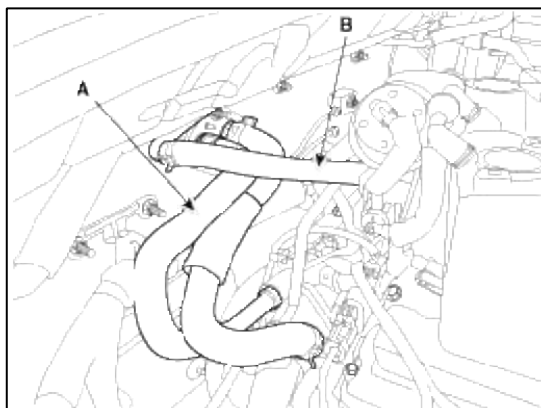
14. Connect the water hose on intake manifold to the nipple on the chain cover.  
 15. Install delivery pipe.(Refer to Delivery pipe in FL Group).  
 16. Install the surge tank and new gasket on the intake manifold.

### Tightening torque

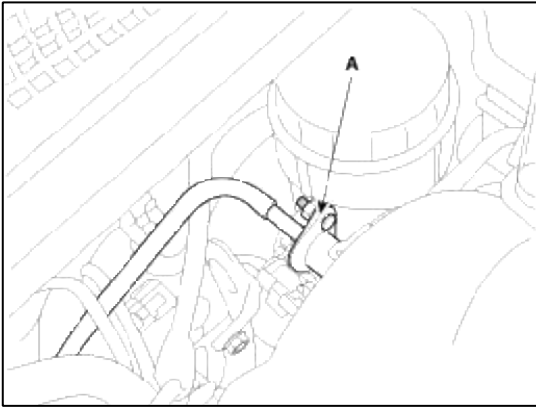
Long bolt : 9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

Short bolt, nut : 18.6 ~ 23.5Nm (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)

17. Connect heater hose(A) and the brake vacume hose(B).

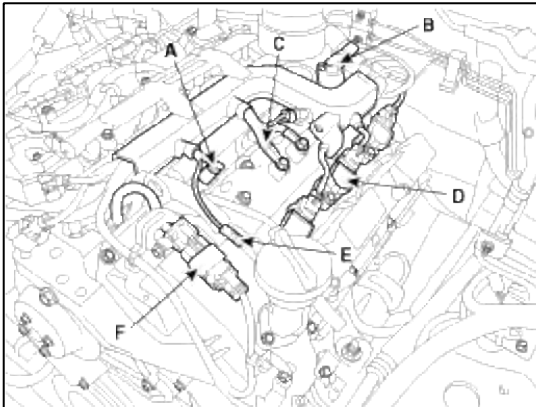


18. Connect the fuel hose tube(A).

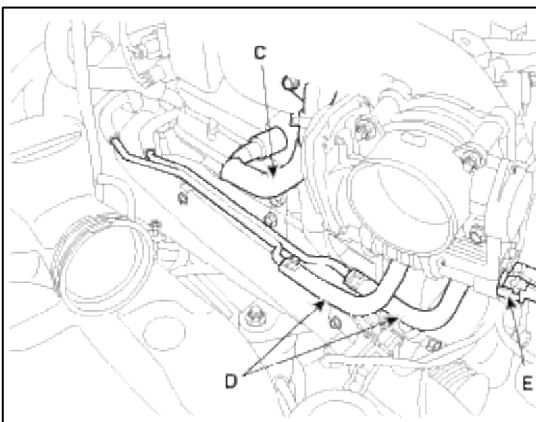


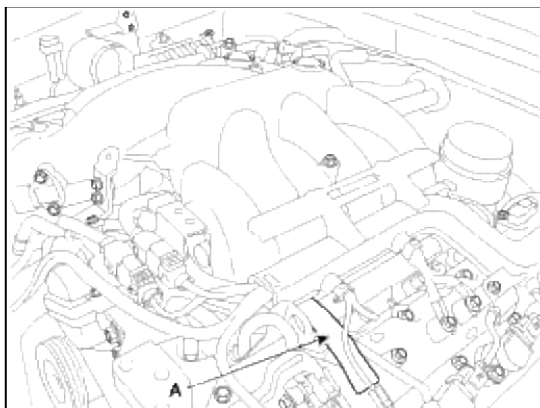
19. Connect the wiring over the surge tank.

- (1) Connect the injection harness connector(A)
- (2) Connect the camshaft position sensor(CMP) harness connector(B).
- (3) Connect the ground lines(C).
- (4) Connect the ignition coil harness connector(D).
- (5) Connect the condensor connector(E).
- (6) Connect the variable induction system(VIS) solenoid valve connector(G).
- (7) Connect the oil control valve(OCV) harness connector(F).

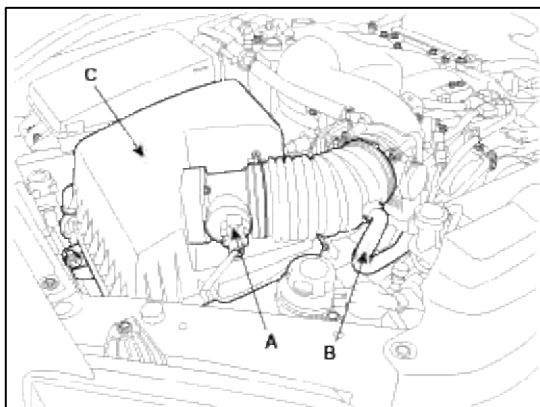


20. Connect the other breather hose(A), the Positive Crankcase Ventilation (PCV) hose(C) and the Electronic Throttle Control(ETC) cooling hoses(D), ETC connector(E).

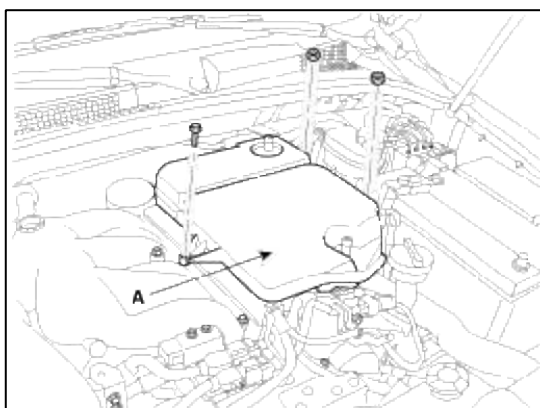




21. After connecting the MAF sensor connector(A) and the breather hose(B), install the air cleaner assembly(C).



22. Install the engine room resonator(A).



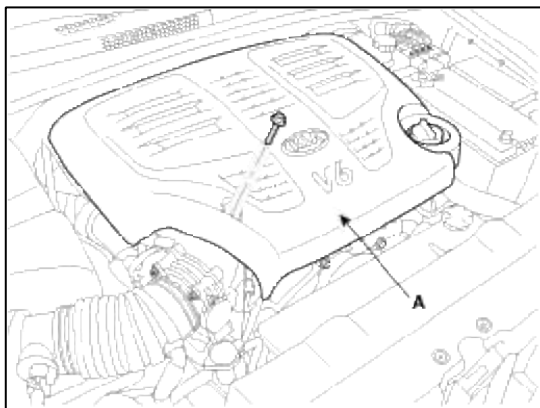
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### Tightening torque

9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

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23. Remove the engine cover(A).



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**Tightening torque**

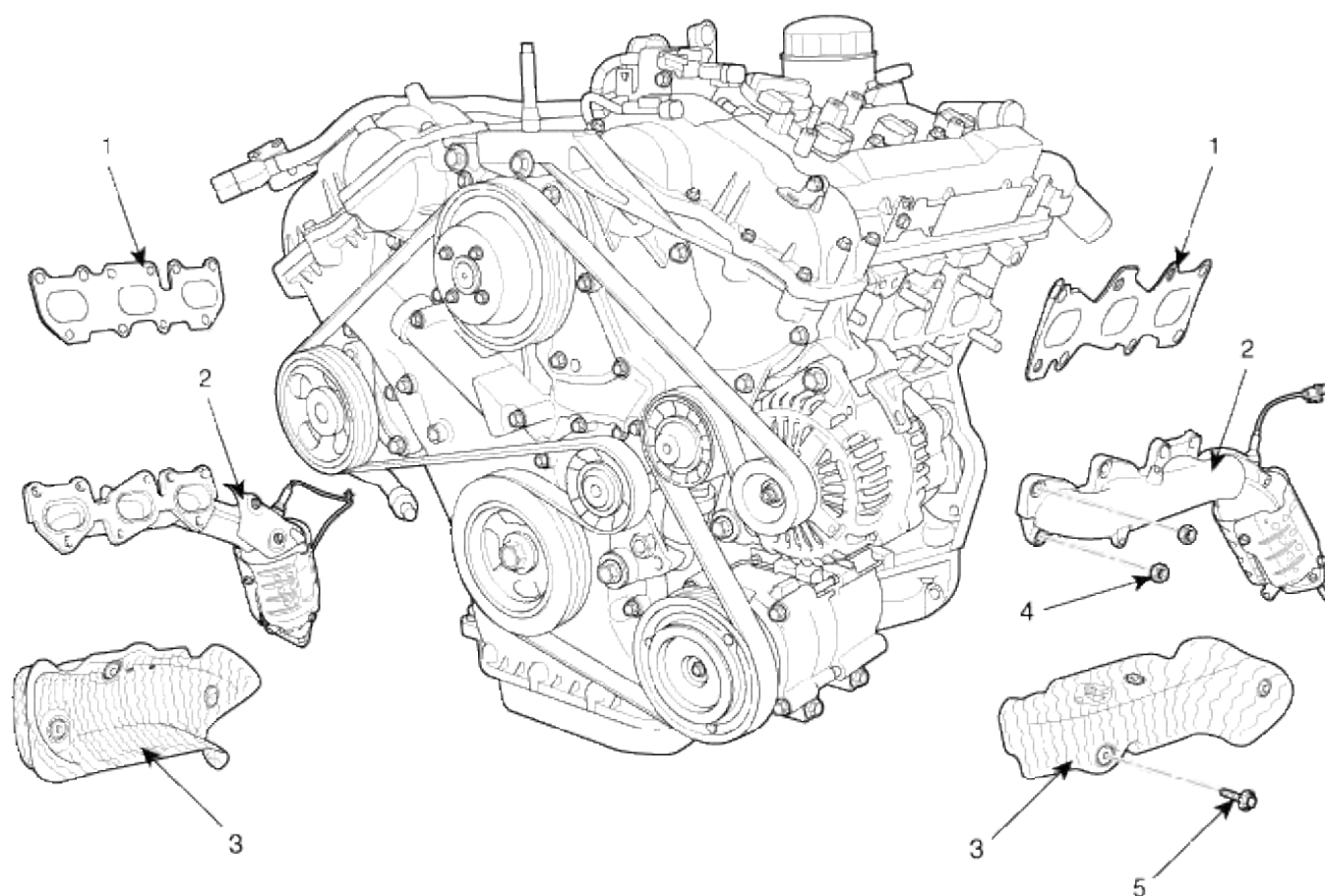
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.68lb-ft)

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**Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Components and Components Location**

COMPONENTS





- 1. Gasket
- 2. Exhaust manifold
- 3. Heat protector

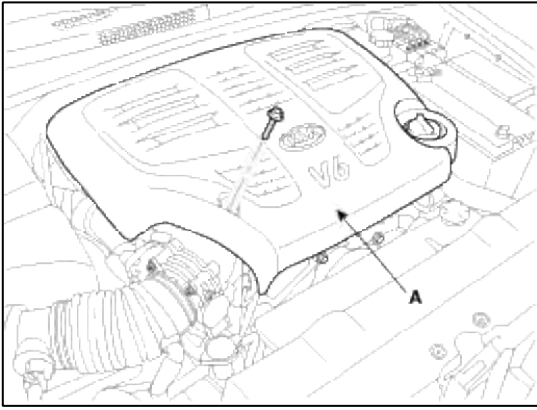
- 4. Self - locking flange nut
- 5. Flange bolt

## Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Repair procedures

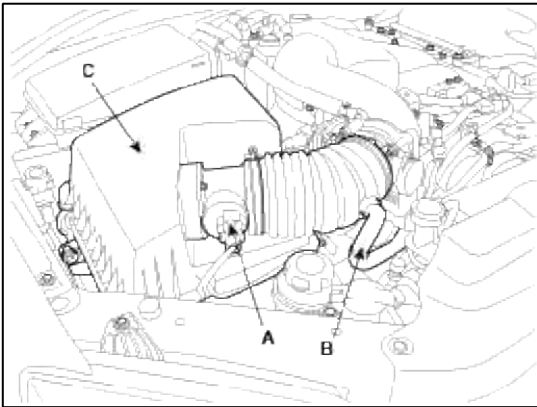
### REPLACEMENT

[RH side or Bank 1]

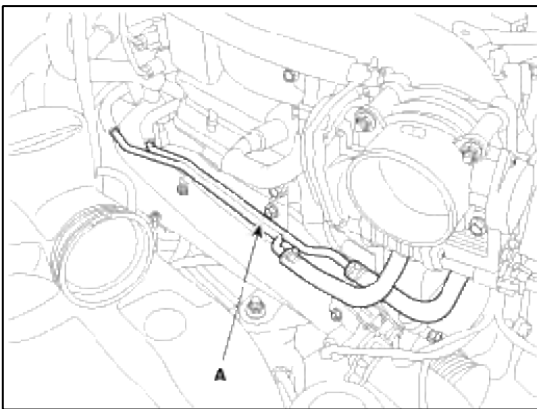
1. Remove the engine cover(A).



2. After disconnecting the MAF sensor connector(A) and the breather hose(B), remove the air cleaner assembly(C).



3. Remove the RH cooling pipe(A).



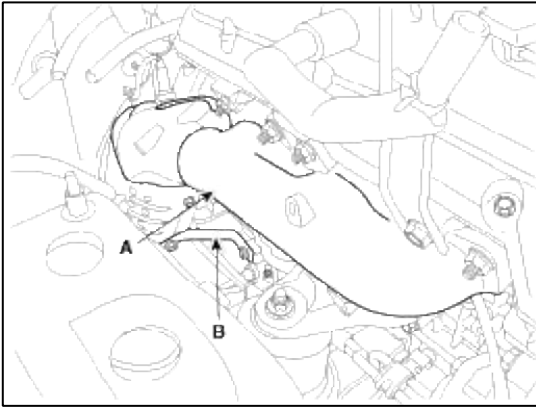
4. Remove the RH exhaust manifold heat protector.

**CAUTION**

Handle the heat protector with caution not to be deformed.

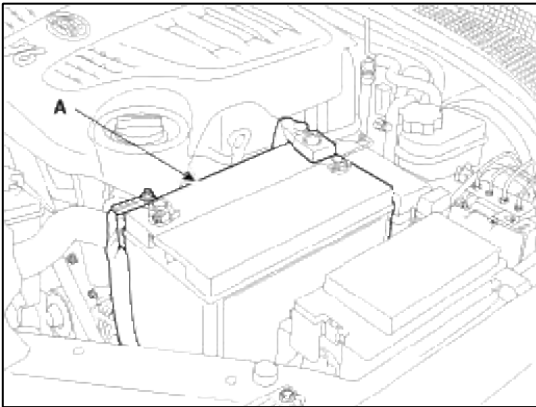
5. After removing the under cover, disconnect the exhaust manifolds from the front muffler.

6. Remove the RH exhaust manifold(A) and the stay(B).



[LH side or Bank 2]

1. Remove the engine oil level gauge.
2. Remove the battery assembly(A).

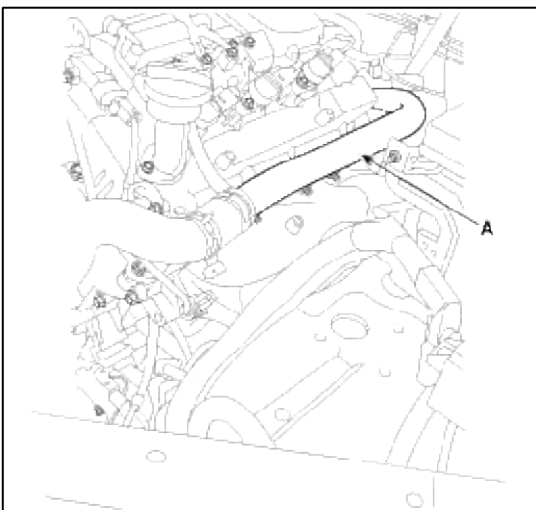


3. Remove the LH exhaust manifold heat protector.

**CAUTION**

Handle the heat protector with caution not to be deformed.

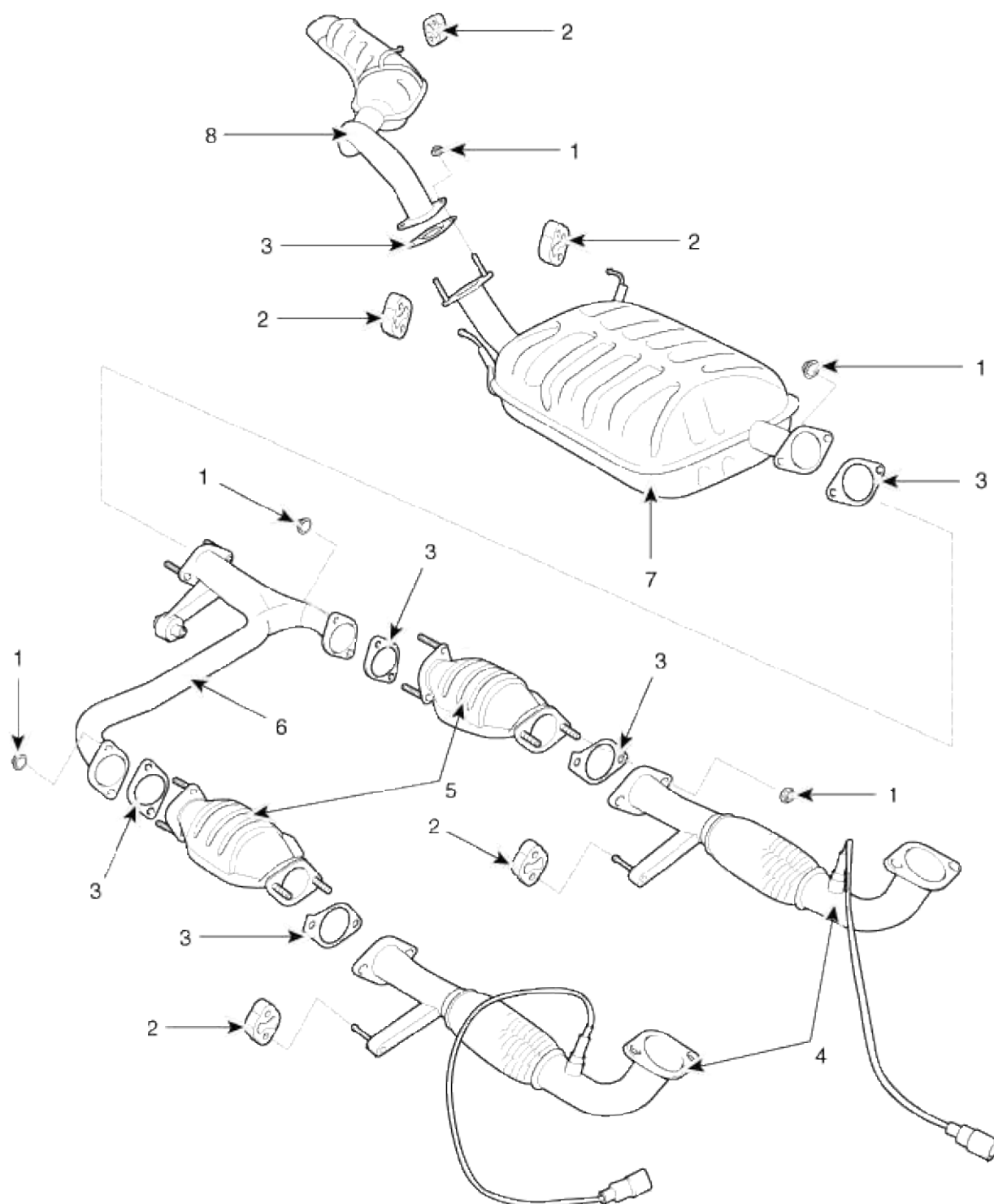
4. Remove the LH cooling pipe(A).



5. Remove the automatic transaxle fluid oil level gauge.
6. Disconnect the oil pressure switch harness connector and the battery ground line.
7. After removing the under cover, disconnect the exhaust manifolds from the front muffler.
8. Remove the LH exhaust manifold.
9. To install, reverse the removal procedure.

## Engine Mechanical System > Intake And Exhaust System > Front Exhsust Pipe > Components and Components Location

### COMPONENTS

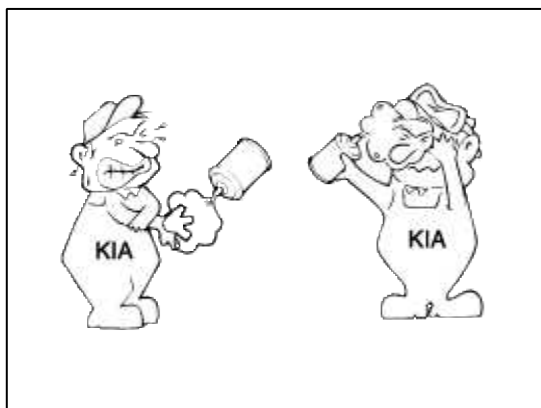


1. Self-locking nut
2. Hanger
3. Gasket
4. Front muffler

5. Catalytic converter
6. Center muffler
7. Main muffler
8. Tail pipe assembly

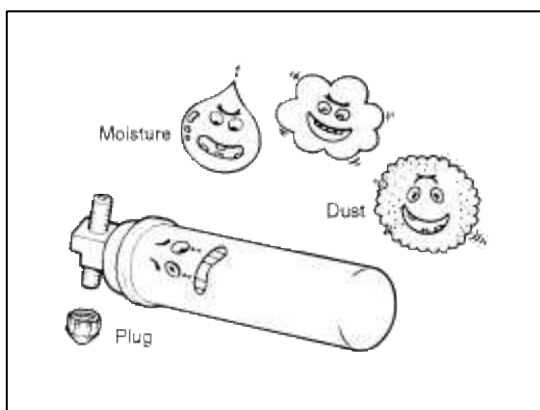
**SORENTO(BL) > 2007 > G 3.3 DOHC > Heating,Ventilation, Air Conditioning****Heating,Ventilation, Air Conditioning > Air conditioning System > General Safety Information and Caution****INSTRUCTIONS****WHEN HANDLING REFRIGERANT**

1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite.  
When handling the refrigerant, be sure to wear gloves.
2. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check that the storage temperature is below 52°C (126°F)
4. An electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended the lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed:
  - A. When removing refrigerant components from a vehicle, cap immediately the components to prevent from the entry of moisture.
  - B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
  - C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
  - D. Use the recommended lubricant from a sealed container only.
7. If an accidental discharge in the system occurs, ventilate the work area before resuming service.

**WHEN REPLACING PARTS ON A/C SYSTEM**

1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a replacement component until it is ready to be installed.

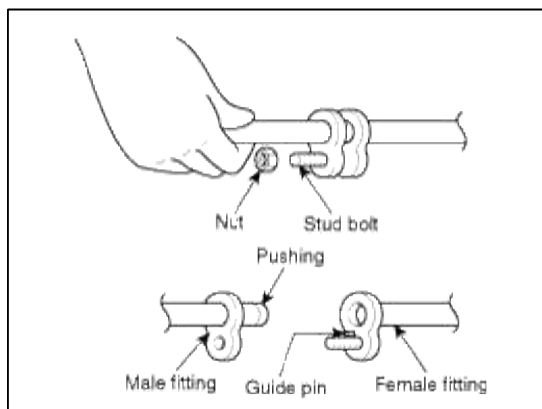
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



#### WHEN INSTALLING CONNECTING PARTS

##### FLANGE WITH GUIDE PIN

Check the new O-ring for damage (use only the specified) and lubricate it using compressor oil. Tighten the nut to specified torque.



Size	Tightening torque [ N.m (kg.m, lbf.ft) ]	
	General bolt, nut	
	4T	7T
M6	5-6 (0.5 - 0.6, 3.6 - 4.3)	9-11 (0.9 - 1.1, 6.5 - 7.9)a
M8	12-14 (1.2 - 1.4, 8.7 - 10)	20 - 26 (2.0 - 2.6, 14 - 18)
M10	25 - 28 (2.5 - 2.8, 18 - 20)	45 - 55 (4.5 - 5.5, 32 - 39)
Size	Flange bolt, nut	
	4T	7T
M6	5-7 (0.5 - 0.7, 3.6 - 5.0)	8-12 (0.8 - 1.2, 5.8 - 8.6)
M8	10-15 (1.0 - 1.5, 7 - 10)	19 - 28 (1.9 - 2.8, 14 - 20)
M10	21 - 31 (2.1 - 3.1, 15 - 22)	39 - 60 (3.9 - 6.0, 28 - 43)

## HANDLING TUBING AND FITTINGS

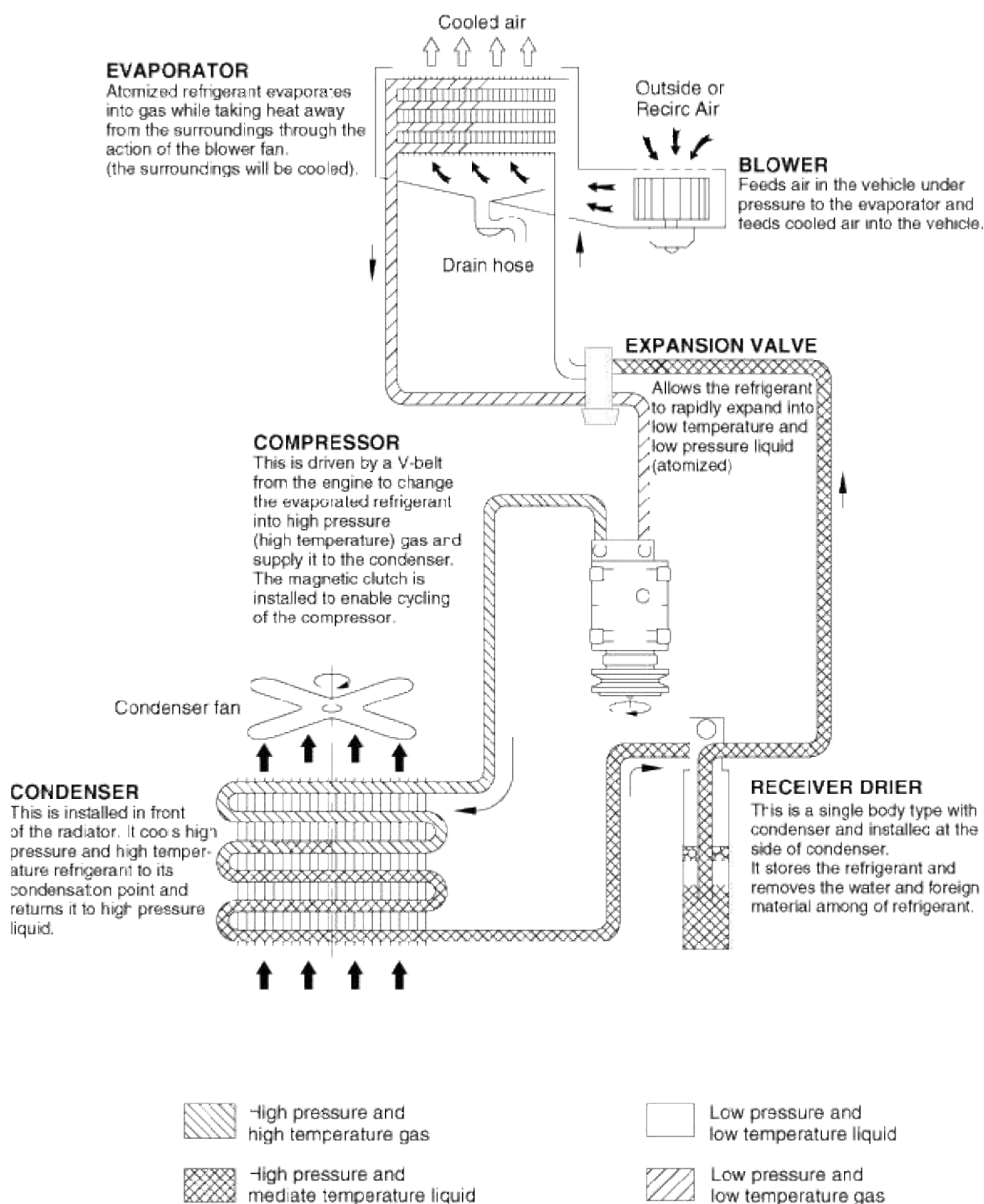
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

### THE FOLLOWING PRECAUTIONS MUST BE OBSERVED

1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines and components in parts stock should be capped or sealed until they are ready to be used.
4. Never attempt to rebind formed lines to fit. Use the correct line for the installation you are servicing.
5. All tools, including the refrigerant dispensing manifold, the gauge set manifold and test hoses, should be kept clean and dry.

## Heating,Ventilation, Air Conditioning > Air conditioning System > Description and Operation

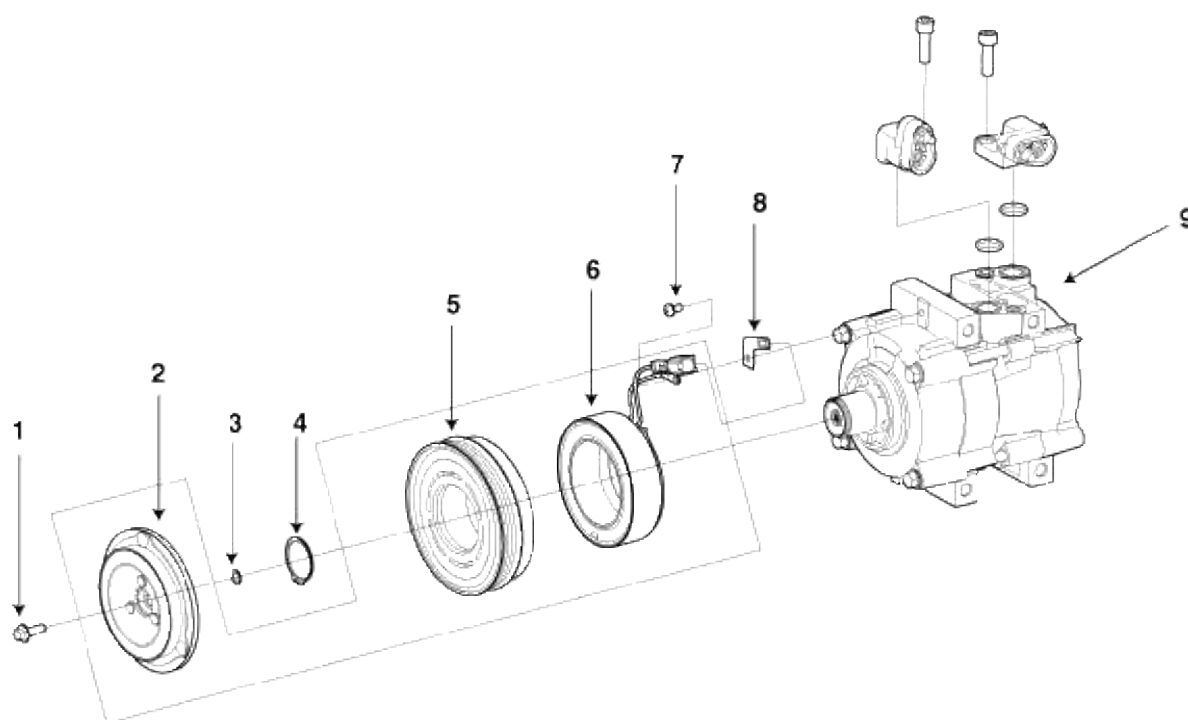
### REFRIGERATION CYCLE



## Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Components and Components Location

### COMPONENTS





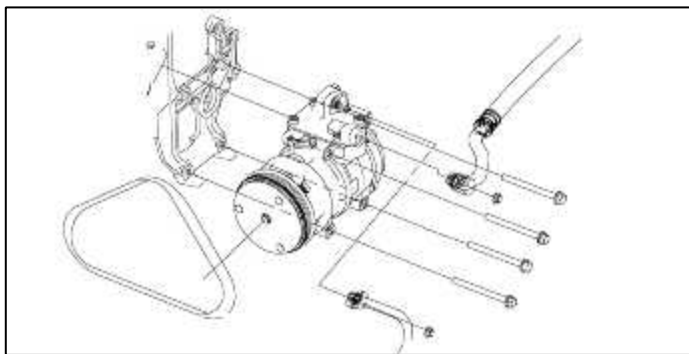
- |                              |                        |
|------------------------------|------------------------|
| 1. Bolt                      | 6. Field coil          |
| 2. Disc & hub assembly       | 7. Screw               |
| 3. Shim (Gap washer) bracket | 8. Connector bracket   |
| 4. Retainer ring (Pulley)    | 9. Compressor assembly |
| 5. Pulley                    |                        |

## Heating, Ventilation, Air Conditioning > Air conditioning System > Compressor > Repair procedures

### REMOVAL

1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station.
4. Loosen the drive belt.
5. Remove the discharge and suction hoses.

6. Disconnect the compressor clutch connector (A), and then remove 4 mounting bolts and the compressor.



Tightening torque :

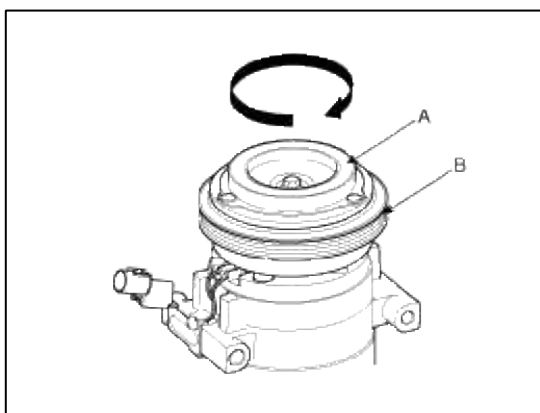
20 - 25 N•m (2.0 - 2.5 kg-m, 14 - 18 lb-ft)

7. Install in the reverse order of removal, and note these items.

- A. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume, Subtract the volume of drained oil from 200cc the result is the amount of oil you should drain from the new compressor (through the suction fitting).
- B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- C. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
- D. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
- E. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.
- F. Adjust the drive belt.
- G. Charge the system and test its performance.

## INSPECTION

1. Check the plated parts of the disc & hub assembly (A) for color changes, peeling or other damage. If there is damage, replace the clutch set.
2. Check the pulley (B) bearing play and drag by rotating the pulley by hand. Replace the clutch set with a new one if it is noisy or has excessive play/drag.



3. Measure the clearance between the pulley (B) and the disc & hub assembly (A) all the way around. If the clearance is not within specified limits, remove the disc & hub assembly and add or remove shim (gap washer) as needed to increase or decrease clearance.

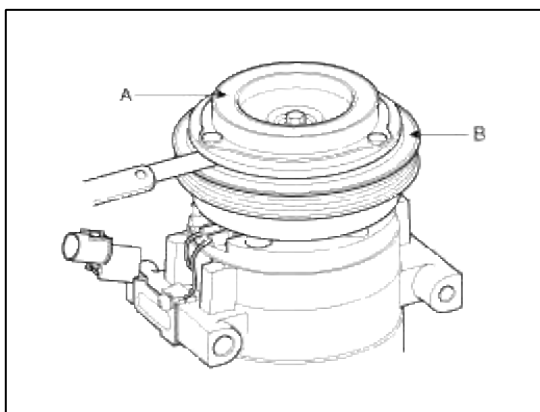
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Clearance :  $0.45 \pm 0.1\text{mm}$  ( $0.018 \pm 0.004$  in.)

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**NOTE**

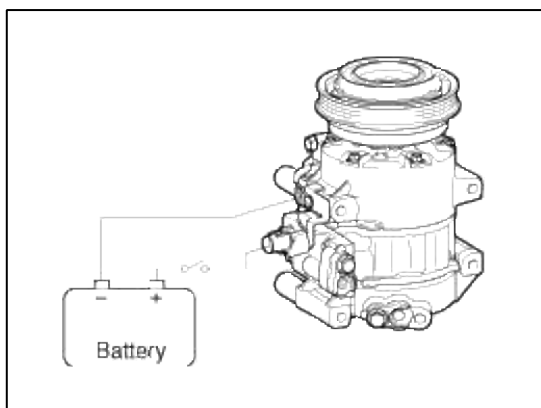
The shims (gap washers) are available in seven thicknesses: 0.7mm, 0.8mm, 0.9mm, 1.0mm, 1.1mm, 1.2mm and 1.3mm.



4. Check operation of the magnetic clutch.

Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body.

Check the magnetic clutch operating noise to determine the condition.



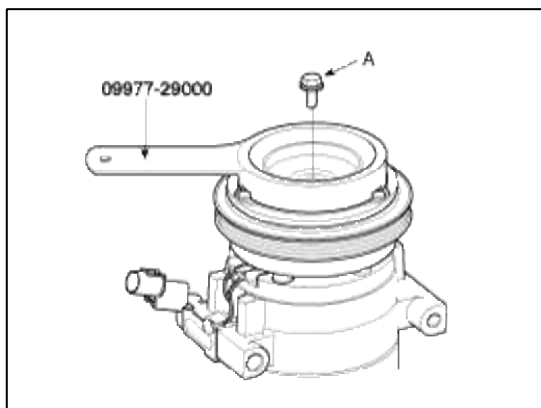
## DISASSEMBLY

1. Remove the center bolt (A) while holding the disc & hub assembly with a commercially available disc & hub assembly bolt remover; Special tool number 09977-29000.

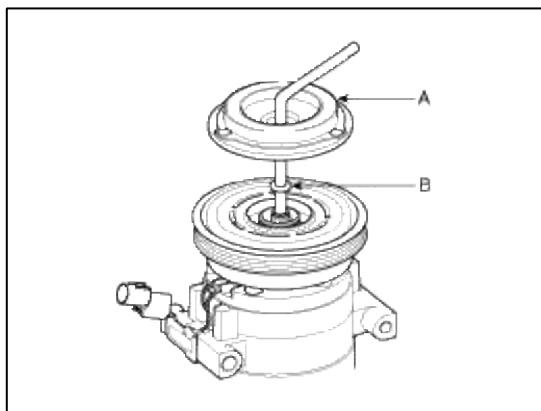
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TORQUE : 10~15N.m (1.02~1.53kgf.m, 7.37~11lb.ft)

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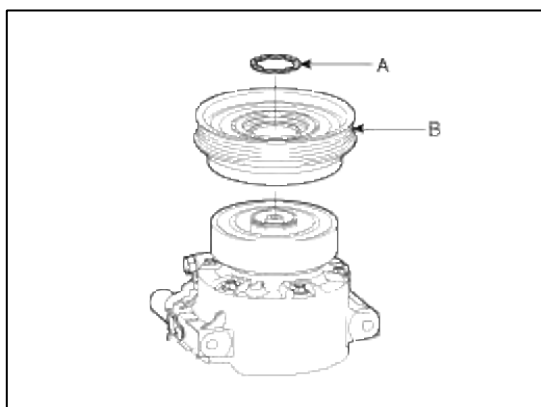
2. Remove the disc & hub assembly (A) and shim (gap washer) (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub assembly, and recheck its clearance (Refer to HA-20).



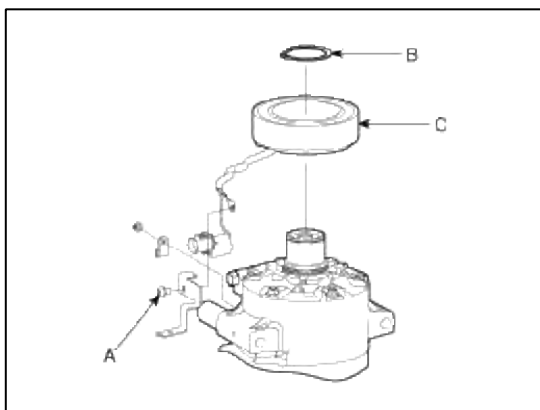
3. If you remove the field coil, remove retainer ring (A) with retainer ring pliers.

**NOTE**

- Be careful not to damage the pulley (B) and compressor during removal/installation.
- Once retainer ring (A) is removed, replace it with a new one.



4. Remove the screw (A) from the field coil ground terminal. Remove the retainer ring (B) and then remove the field coil (C) from the shaft with a puller. Be careful not to damage the coil and compressor.



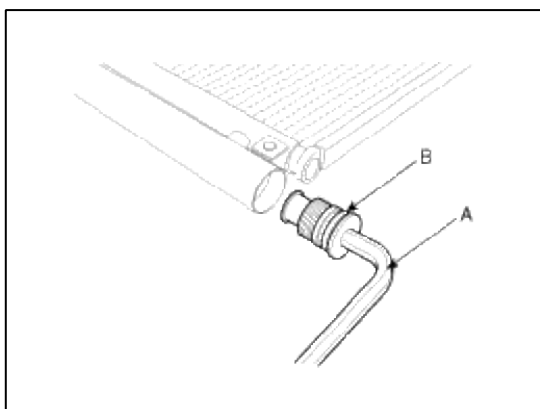
5. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
  - A. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
  - B. Install new retainer rings, and make sure they are fully seated in the groove.
  - C. Make sure that the pulley turns smoothly after its reassembled.

### Heating,Ventilation, Air Conditioning > Air conditioning System > Receiver/Drier > Repair procedures

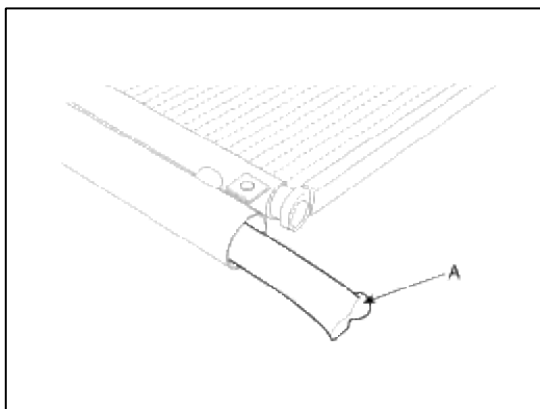
#### REPLACEMENT

1. Remove the condenser, and then remove the bottom cap (B) with L wrench (A) from the condenser.

TORQUE: 0.98~1.47N.m (0.1~0.15kgf.m, 0.72~1.85lb-ft)



2. Remove the desiccant (A) from condenser using a long nose plier. Check for crumbled desiccant and clogged bottom cap filter.



3. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
4. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.

5. Install the new bottom cap to the condenser.

#### NOTE

- Always replace the desiccant and bottom cap at the same time.
- Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- Be careful not to damage the radiator and condenser fins when installing the condenser.
- Be sure to install the lower mount cushions of condenser securely into the holes.
- Charge the system, and test its performance.

### Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Description and Operation

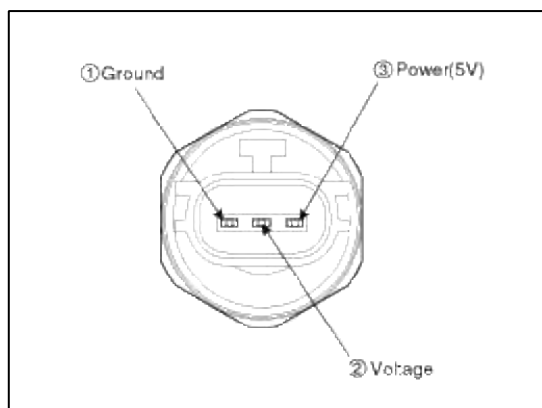
#### DESCRIPTION

A/C pressure transducer convert the pressure value of high pressure line into voltage value after measure it. By converted voltage value, engine ECU controls cooling fan by operating it high speed or low speed. Engine ECU stop the operation of compressor when the temperature of refrigerant line is so high or so low irregularly to optimize air conditioning system.

### Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Repair procedures

#### INSPECTION

1. Measure the pressure of high pressure line by measuring voltage output between NO.1 and NO.2 terminals.



2. Inspect the voltage value whether it is sufficient to be regular value or not.

---


$$\text{Voltage} = \text{Vdd} * (0.025 * P + 0.1) \text{ [Kgf/cm}^2\text{]}$$

$$\text{Voltage} = \text{Vdd} * (0.254929 * P + 0.1) \text{ [Mpa]}$$

$$\text{Voltage} = \text{Vdd} * (0.001758 * P + 0.074162) \text{ [PSIA]}$$

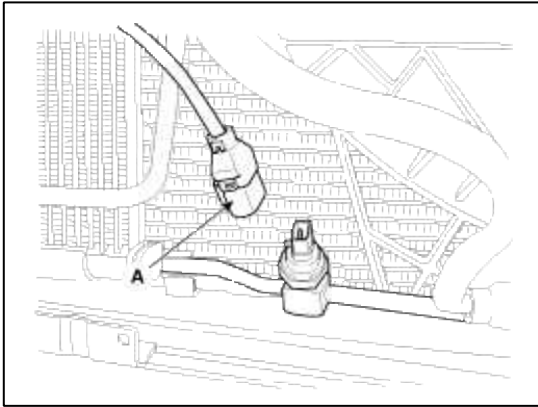

---

3. If the measured voltage value is not specification, replace the A/C pressure transducer.

#### REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/charging station.
3. Remove the front bumper(Refer to BD group-front bumper).

4. Disconnect A/C pressure transducer connector (3P) (A).



5. Remove the A/C pressure transducer.

**CAUTION**

Take care that liquid & suction pipe are not bent.

6. Installation is the reverse order of removal.

---

TORQUE: 10~12N.m (1.0~1.2kgf.m, 7.4~8.8lbf.ft)

---

**Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Description and Operation**

**DESCRIPTION**

The evaporator temperature sensor will detect the evaporator core temperature and interrupt compressor relay power in order to prevent evaporator freezing by excessive cooling.

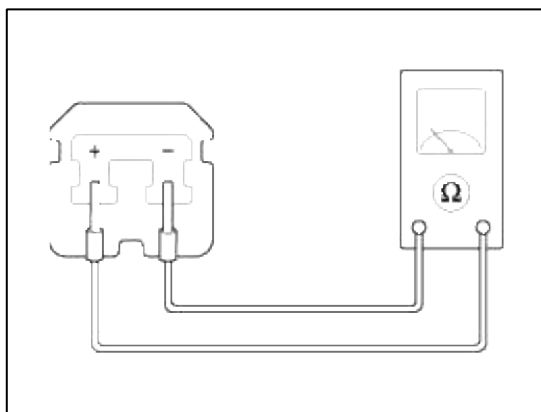
It is a negative type thermistor whose resistance is inversely proportional to temperature.

**Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Repair procedures**

**INSPECTION**

1. Engine "ON", Aircon s/w "ON"

2. Using the multi-tester, Measure resistance between terminal "1" and "2" of evaporator temperature sensor.



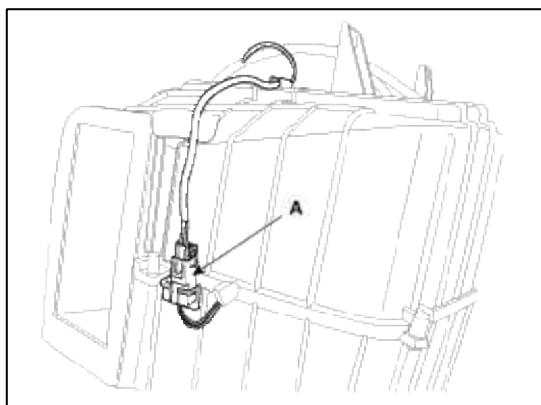
**[Specification]**

Evaporator core temperature [°C (°F)]	Resistance [kΩ]
-10(14)	18.01
-5(23)	14.25
0(32)	11.36
5(41)	9.12
10(50)	7.37
15(59)	5.99
20(68)	4.9
25(77)	4.03
30(86)	3.33
35(95)	2.77
40(104)	2.31

3. If the measured resistance is not specification, substitute with a known-good evaporator temperature sensor and check for proper operation.
4. If the problem is corrected, replace the evaporator temperature sensor.

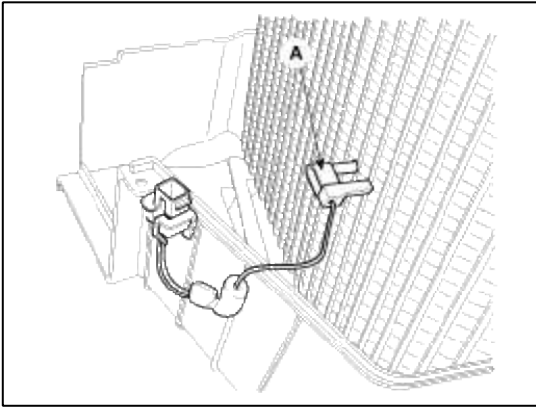
**REPLACEMENT**

1. Remove cresh pad(Refer to BD group-creshpad).
2. Remove the cowl cross bar(Refer to BD group-cresh pad).
3. Remove the blower unit.
4. Disconnect the evaporator connector(A).





5. Remove the blower unit case(Refer to blower unit)
6. Remove the evaporator sensor(A).

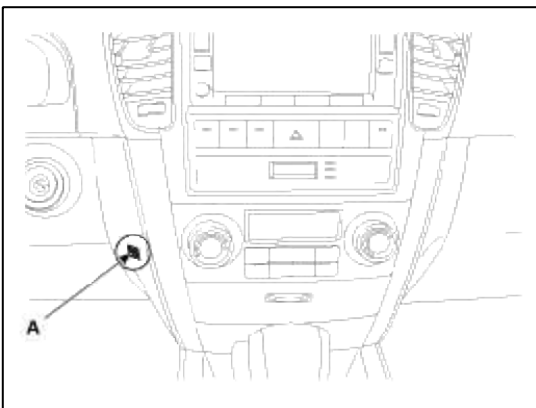


7. Installation is the reverse order of removal.

### Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Description and Operation

#### DESCRIPTION

1. In-car air temperature sensor is located at the center facia lower panel.
2. The sensor contains a thermistor which measures the temperature of the inside. The signal decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal the control unit regulates incar temperature to intended value.

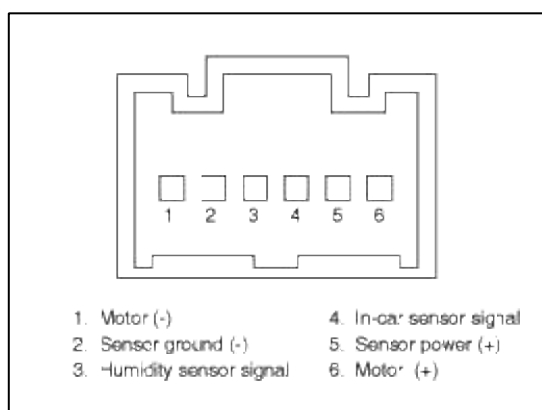


### Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Repair procedures

#### INSPECTION

1. Ignition "ON"

2. Blow air with changing temperature to the in car sensor air inlet. Measure sensor resistance between 2 and 4 terminals.



### [Specification]

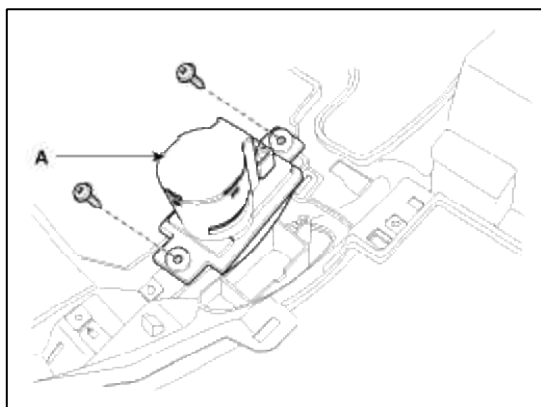
Temperature[°C (°F)]	Resistance between terminals 2 and 4 (kΩ)
-35(-31)	687.46
-30(-22)	509.57
-15(5)	216.07
0(32)	97.71
15(59)	47.13
25(77)	30
35(95)	19.59
45(113)	13.10
55(131)	8.96

### NOTE

In car sensor is negative type thermistor that resistance will rise with lower temperature, and reduce with higher temperature.

### REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the cresh pad (Refer to BD group-cresh pad).
3. Disconnect the connector of in-car sensor .Loosen the mounting 2 screws and then remove the in-car sensor (A).



4. Installation is the reverse order of removal.

## Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Description and Operation

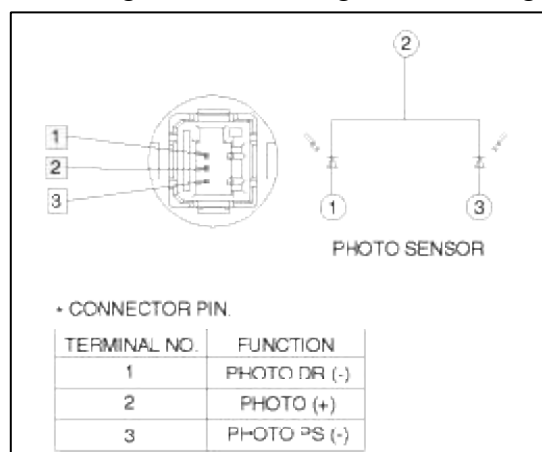
### DESCRIPTION

1. The photo sensor (A) is located at the center of defrost nozzle.
2. The photo sensor contains a photovoltaic (sensitive to sunlight) diode. The solar radiation received by its light receiving portion, generates an electromotive force in proportion to the amount of radiation received which is transferred to the automatic temperature control module so that the solar radiation compensation will be performed.

## Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Repair procedures

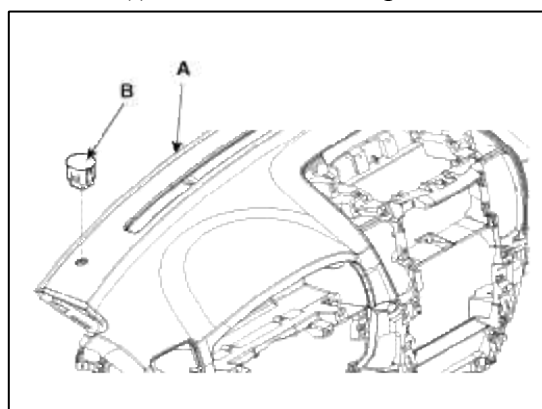
### INSPECTION

1. Ignition "ON"
2. Emit intensive light toward photo sensor using a lamp, and check the output voltage change between terminal 2 and 1.
3. Check the output voltage change between terminal 3 and GND.
4. The voltage will rise with higher intensive light and reduce with lower intensive light.



### REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. With the (-) driver, remove the photo sensor (B) from the left of defrost nozzle (A).



3. Install in the reverse order of removal.

## Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Description and Operation

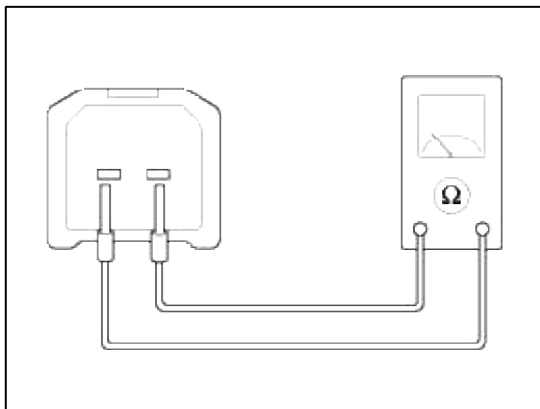
### DESCRIPTION

1. Water temperature sensor is located at the heater unit.
2. It detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

### Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Repair procedures

#### INSPECTION

1. Ignition "ON"
2. Using the multi-tester, Measure resistance between terminal "1" and "2" of water temperature sensor.



#### [Specification]

Coolant temperature[°C(F°)]	Resistance (kΩ)
-30(-22)	176.3
-20(-4)	96.44
-10(14)	54.99
0(32)	32.51
10(50)	19.85
20(68)	12.48
30(86)	8.061
40(104)	5.334

3. If the measured resistance is not specification, substitute with a known-good water temperature sensor and check for proper operation.
4. If the problem is corrected, replace the water temperature sensor.

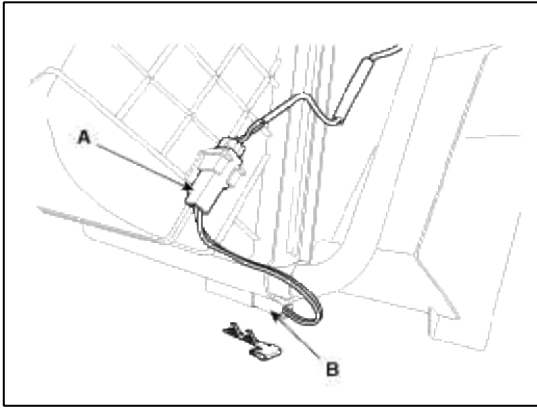
#### NOTE

Negative type thermistor that resistance will rise with lower temperature, and reduce with higher temperature.

#### REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the grove box. (Refer to BD group - crash pad)

3. Disconnect the connector (A) of water temperature sensor (B) and then remove the water temperature sensor by pulling out.



4. Installation is the reverse order of removal.

#### NOTE

Take care that wire of water temperature sensor is not to be damaged

### Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Description and Operation

#### DESCRIPTION

1. The ambient temperature sensor is located at the front of the condenser and detects ambient air temperature. It is a negative type thermistor; resistance will increase with lower temperature, and decrease with higher temperatures.
2. The sensor output will be used for discharge temperature control, temperature regulation door control, blower motor level control, mix mode control and in-car humidity control.

#### NOTE

If the ambient temperature is below 2.0°C (35.6°F), the A/C compressor will be stopped.  
The compressor will be operated by manual operating.

### Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Repair procedures

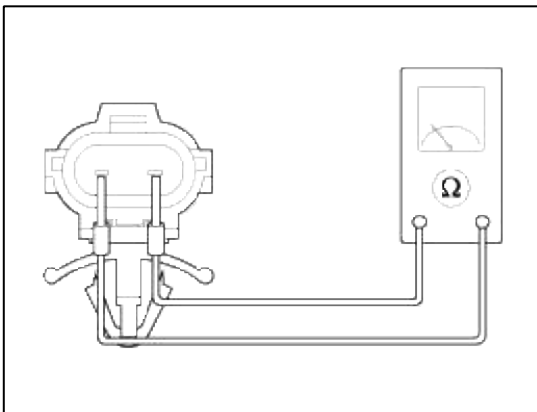
#### INSPECTION

1. Ignition "OFF"
2. Disconnect ambient temperature sensor.

3. Check the resistance of ambient temperature sensor between terminals 1 and 2 whether it is changed by changing of the ambient temperature.

**[Specification]**

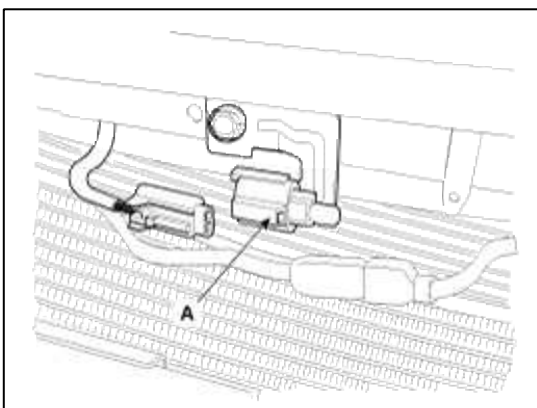
Ambient temperature[°C(°F)]	Resistance between terminals 1 and 2 (kΩ)
-30(-22)	508.04
-20(-4)	271.45
-10(14)	158.32
0(32)	95.096
10(50)	58.764
20(68)	37.30
30(86)	24.274
40(104)	16.165
50(122)	10.995
60(140)	7.625



4. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.
5. If the problem is corrected, replace the ambient temperature sensor.

**REPLACEMENT**

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to BD group - Front bumper)
3. Remove the ambient temperature sensor (A).



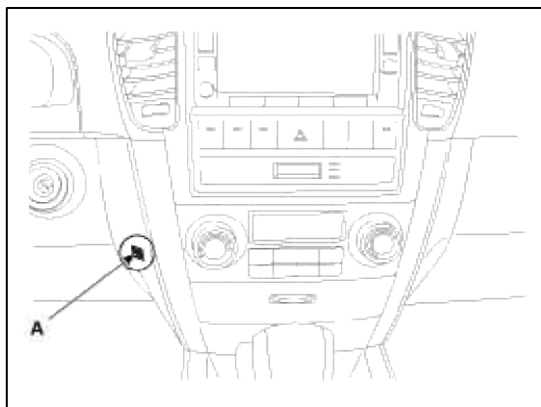
4. Installation is the reverse order of removal.

## Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Description and Operation

### DESCRIPTION

1. Humidity sensor is located at the lower crash pad and detected in-car humidity for in-car humidity control.
2. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity preventing in car fogging.

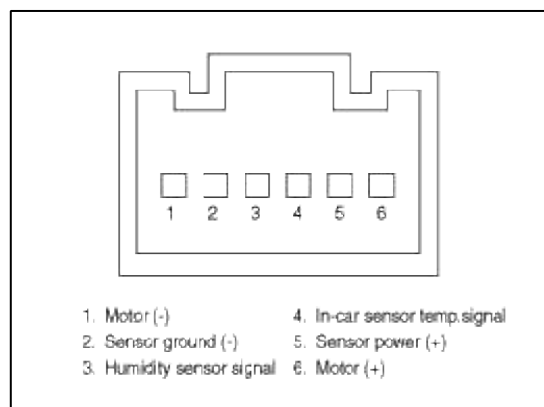
Air conditioner operation depends on ambient temperature and humidity.



## Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Repair procedures

### INSPECTION

1. Ignition "ON"
2. Using the scan tool.
3. Check the frequency of humidity sensor between terminals 2 and 3.



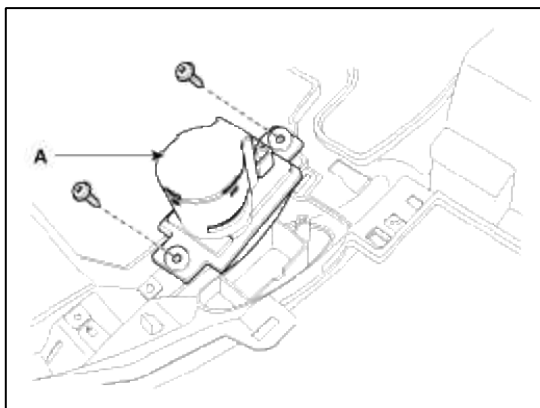
Humidity (%)	Frequency between terminals 2 and 3 (Hz)
30	6976 ± 5%
50	6728 ± 5%
60	6600 ± 5%
70	6468 ± 5%
80	6330 ± 5%
90	6186 ± 10%

4. If the measured resistance is not specification, substitute with a known-good humidity sensor and check for proper operation.

5. If the problem is corrected, replace the Humidity sensor.

## REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad (Refer to BD group-crash pad)
3. Loosen 2 screws and then remove the humidity sensor (A).



4. Installation is the reverse order of removal.

## Heating,Ventilation, Air Conditioning > Air conditioning System > Repair procedures

### REFRIGERANT SYSTEM SERVICE BASICS

#### REFRIGERANT RECOVERY

Use only service equipment that is U.L.-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

#### CAUTION

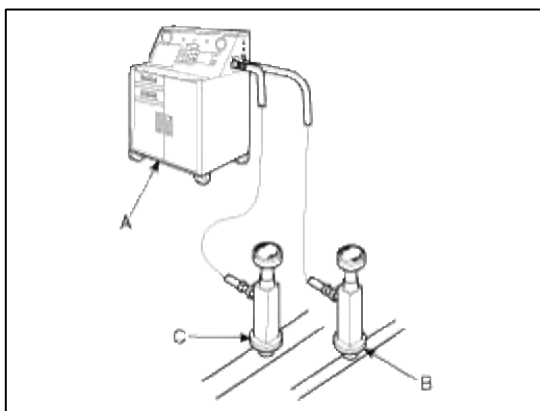
- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.

Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant

Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



2. Measure the amount of refrigerant oil removed from the A/C system after the recovery process is completed. Be sure to install the same amount of new refrigerant oil back into the A/C system before charging.

#### SYSTEM EVACUATION

Use only service equipment that is U.L.-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.



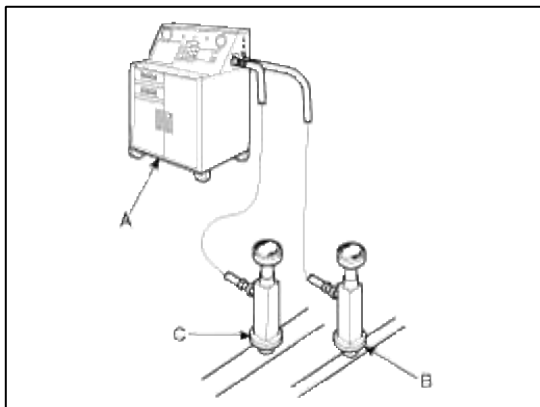
**CAUTION**

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.

Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. When an A/C System has been opened to the atmosphere, such as during installation or repair, it must be evacuated using an R-134a refrigerant Recovery/Recycling/Charging System. (If the system has been open for several days, the receiver/dryer should be replaced, and the system should be evacuated for several hours.)
2. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



3. If the low-pressure does not reach more than 93.3 kPa (700 mmHg, 27.6 in.Hg) in 10 minutes, there is probably a leak in the system. Partially charge the system, and check for leaks (see Leak Test.).
4. Remove the low pressure valve from the low-pressure service port.

**SYSTEM CHARGING**

Use only service equipment that is U.L.-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

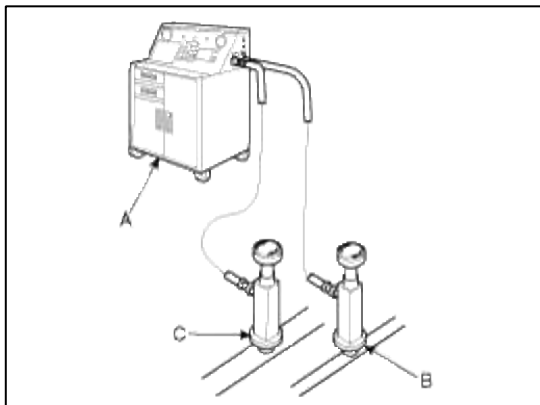
**CAUTION**

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.

Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) as shown, following the equipment manufacturer's instructions.



2. Add the same amount of new refrigerant oil to system that was removed during recovery. Use only specified refrigerant oil. Charge the system with  $18.25 \pm 0.85$  oz. ( $540 \pm 25$ g) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

#### REFRIGERANT LEAK TEST

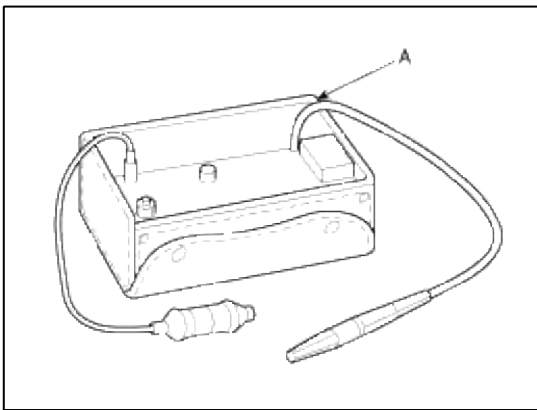
Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

##### NOTE

In order to use the leak detector properly, read the manual supplied by the manufacturer.

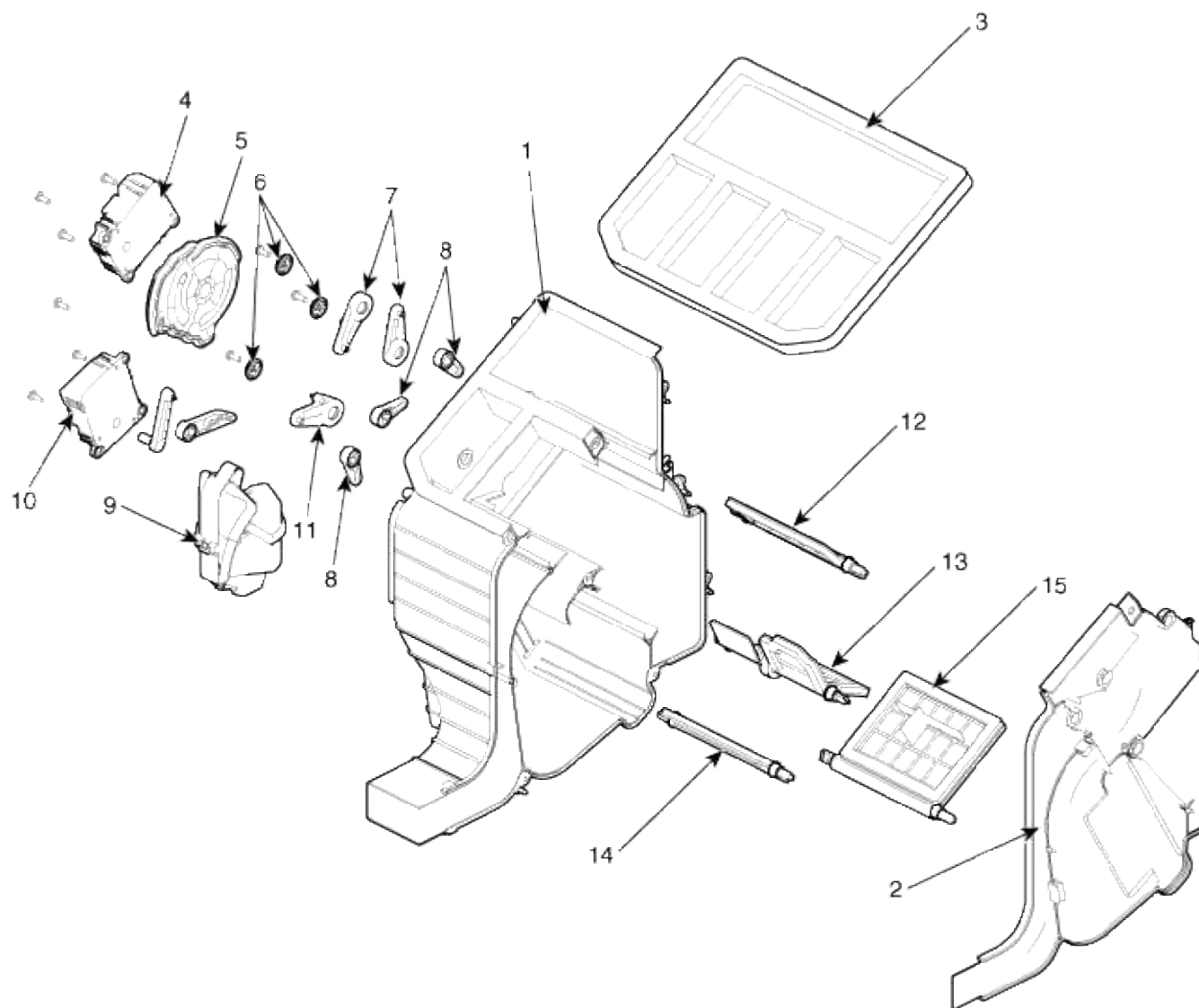
If a gas leak is detected, proceed as follows:

1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector (A).
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.
3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.

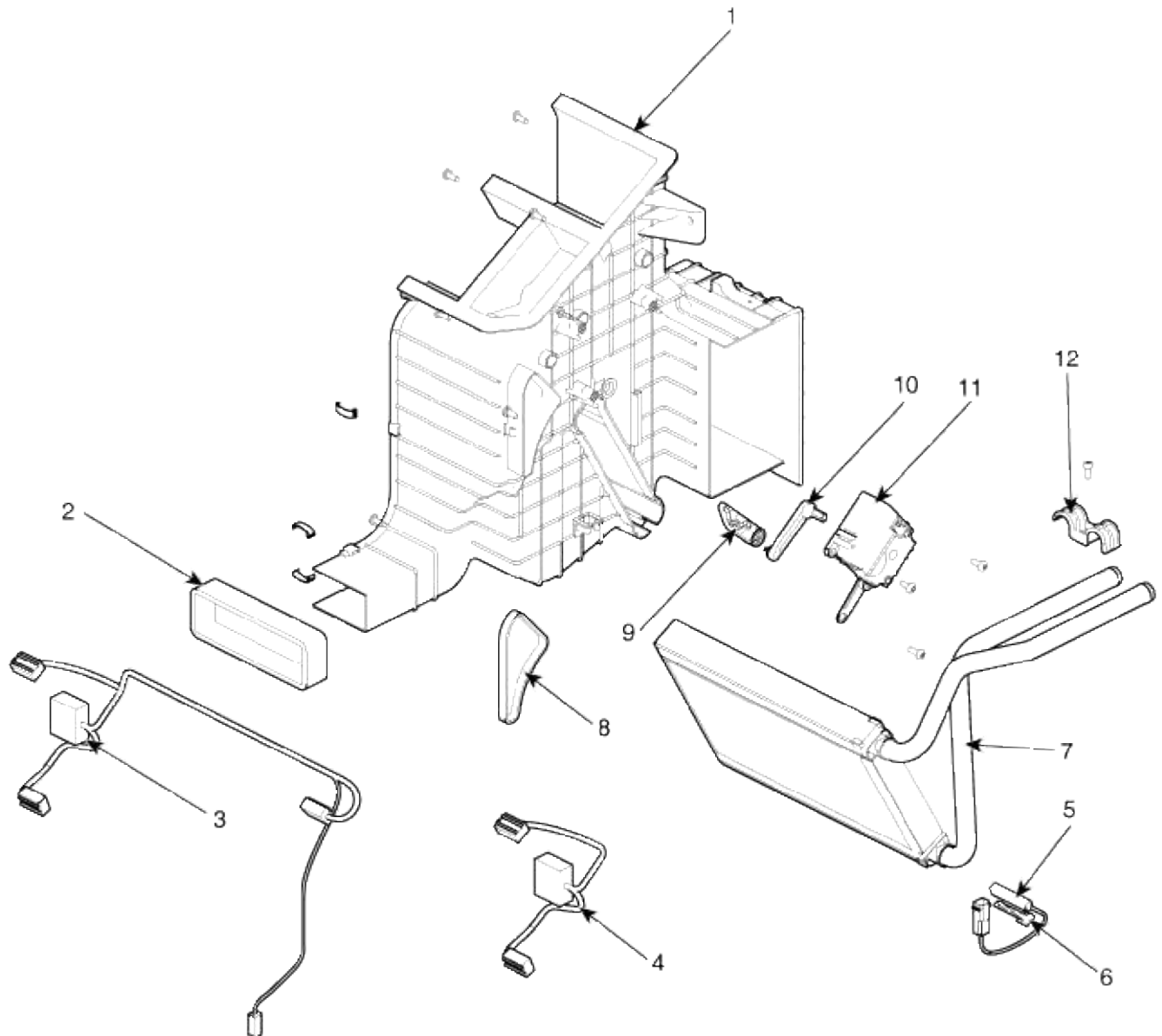


**Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Components and Components Location**

#### COMPONENTS



- |                                 |                    |
|---------------------------------|--------------------|
| 1. Heater case (L)              | 9. Shower duct (L) |
| 2. Heater separator (Dual type) | 10. Temp actuator  |
| 3. Heater seal                  | 11. Foot sub lever |
| 4. Mode actuator                | 12. Def door       |
| 5. Mode actuator lever          | 13. Vent door      |
| 6. Washer                       | 14. Foot door      |
| 7. Vent / Def sub lever         | 15. Temp door      |
| 8. Vent / Foot Def lever        |                    |



- |                                     |                              |
|-------------------------------------|------------------------------|
| 1. Heater case(R)                   | 7. Heater core               |
| 2. Foot seal                        | 8. Foot lining seal          |
| 3. Wire haness                      | 9. Temp actuator door        |
| 4. Wire haness                      | 10. Temp actuator door lever |
| 5. Water temperature sensor         | 11. Temp actuator            |
| 6. Water temperature sensor stopper | 12. Heater core cover        |

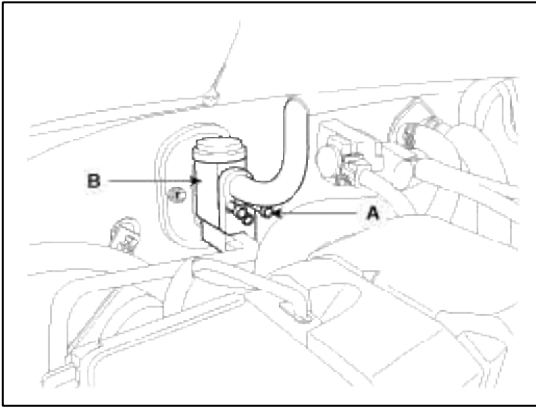
## Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Repair procedures

### REPLACEMENT

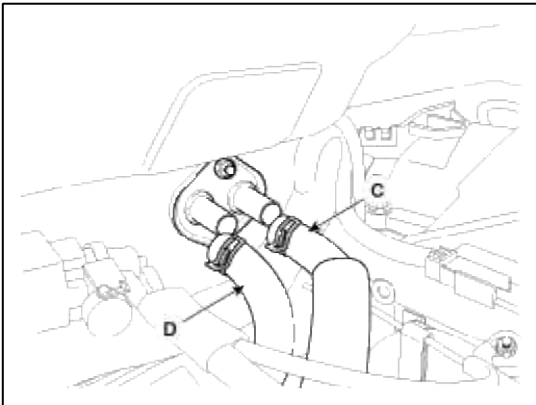
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.

4. Remove the bolts (A) and the expansion valve (B) from the evaporator core.

Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



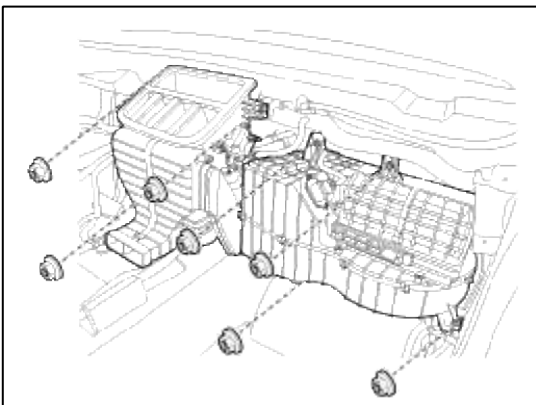
5. Disconnect the inlet (C) and outlet (D) heater hoses from the heater unit.



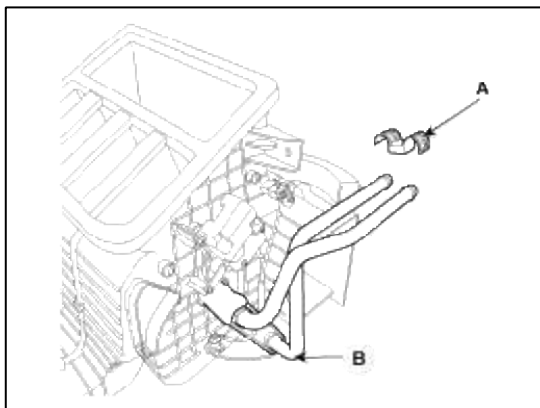
**CAUTION**

Engine coolant will run out when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

6. Remove the crash pad (Refer to BD group-crash pad).
7. Remove the cowl cross bar assembly. (Refer to BD group-crash pad)
8. Disconnect the connectors from the temperature control actuator, the mode control actuator and the evaporator temperature sensor.
9. Remove the heater blower unit after loosening 7 mounting nuts.



10. Remove the heater core (B) after remove the cover (A).



11. Installation is the reverse order of removal, and note these items :

- A. If you're installing a new evaporator, add refrigerant oil (ND-OIL8).
- B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
- D. Do not spill the refrigerant oil on the vehicle ; it may damage the paint ; if the refrigerant oil contacts the paint, wash it off immediately
- E. Apply sealant to the grommets.
- F. Make sure that there is no air leakage.
- G. Charge the system and test its performance.
- H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
- I. Refill the cooling system with engine coolant.

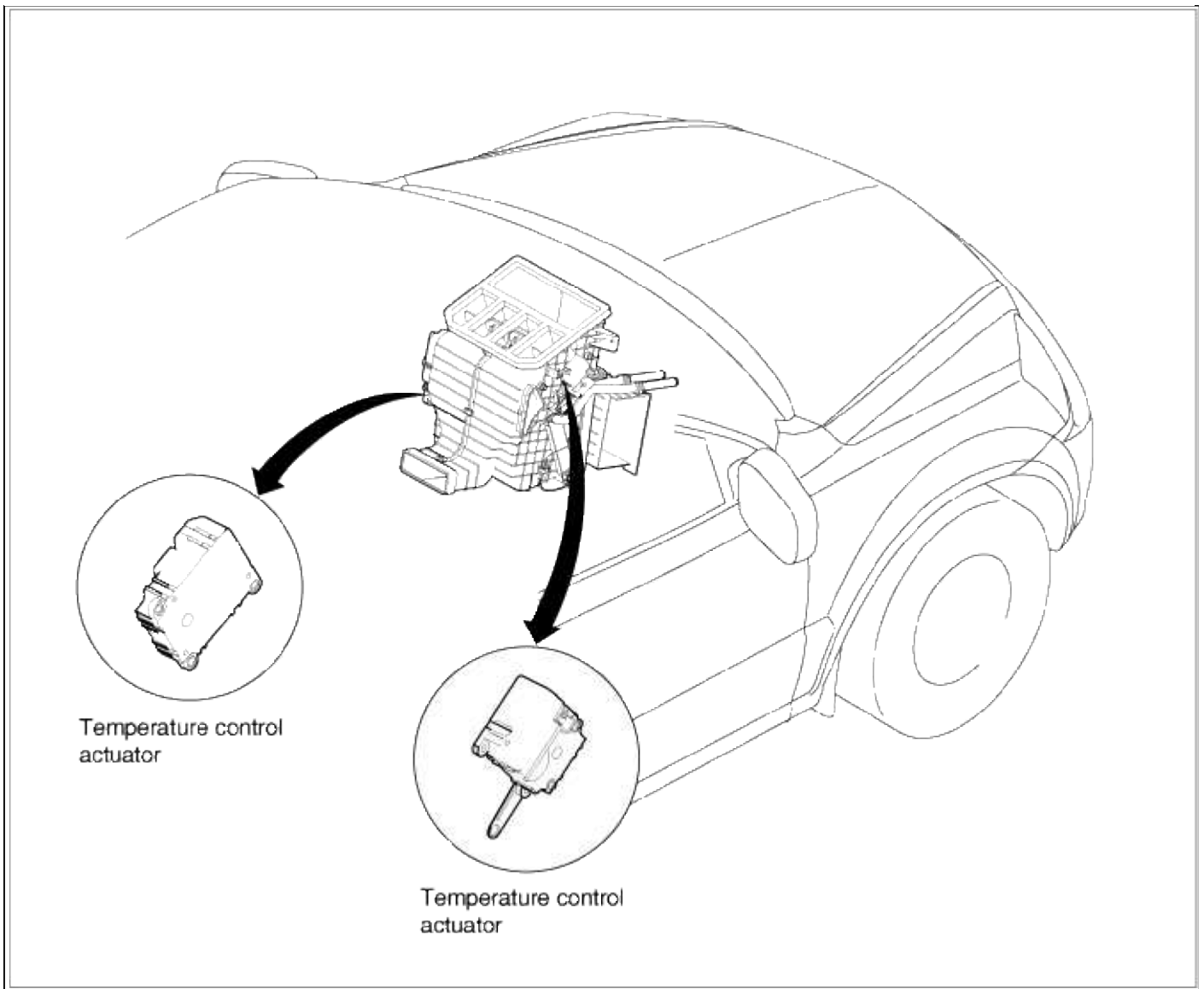
### **Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Description and Operation**

#### **DESCRIPTION**

1. Heater unit includes mode control actuator and temperature control actuator.
2. Temperature control actuator is located at the heater unit. It regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temperature door by operating temperature switch and then temperature will be regulated by the hot/cold air ratio decided by position of temperature door.

### **Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Components and Components Location**

#### **COMPONENT LOCATION**



### Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Repair procedures

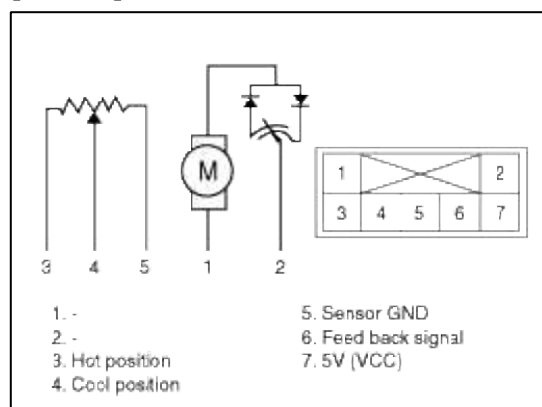
#### INSPECTION

1. Ignition "OFF"
2. Disconnect the connector of temperature control actuator.

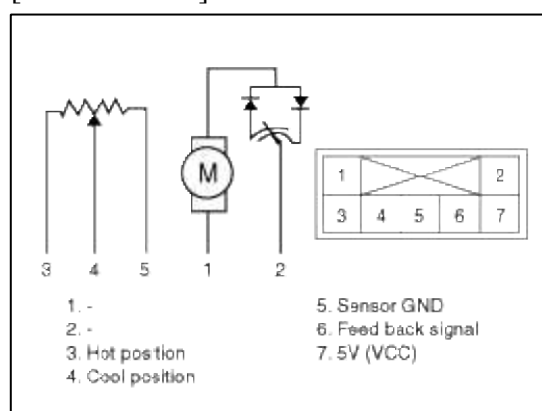
3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 3 and grounding terminal 4.

Verify that the temperature control actuator operates to the cool position when connecting in the reverse.

#### [DRIVE]



#### [PASSENGER]



4. Check the voltage between terminals 5 and 6.

#### [Specification]

Door position	Voltage (5-6)	Error detecting
Max. cooling	$0.3 \pm 0.15V$	Low voltage : 0.1V or less
Max. heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more

It will feedback current position of actuator to controls.

5. If the measured voltage is not specification, substitute with a known-good temperature control actuator and check for proper operation.
6. If the problem is corrected, replace the temperature control actuator.

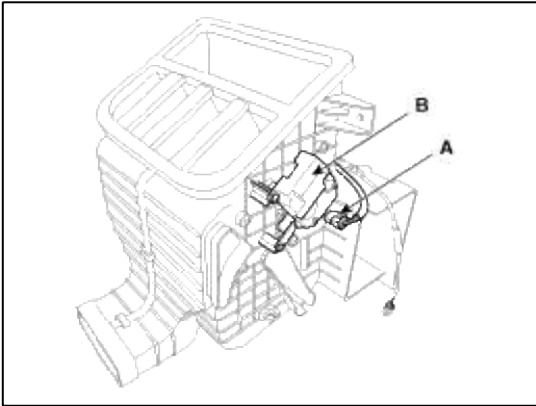
#### REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the driver's crush pad lower panel (Refer to BD group).
3. Disconnect the temperature control actuator connector (A) after removing the air duct.

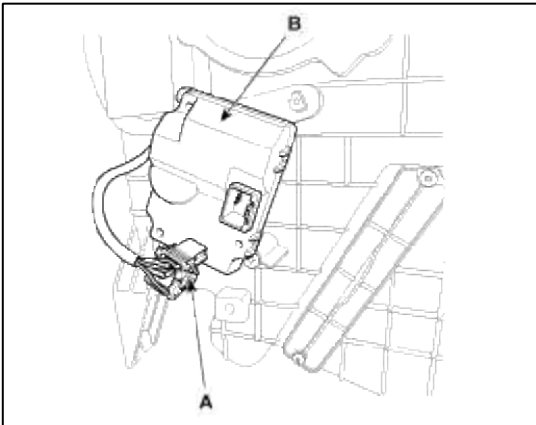


4. Loosen the mounting screw and then remove the temperature control actuator (B).

[DRIVE]



[PASSENGER]



5. Installation is the reverse order of removal.

## Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Description and Operation

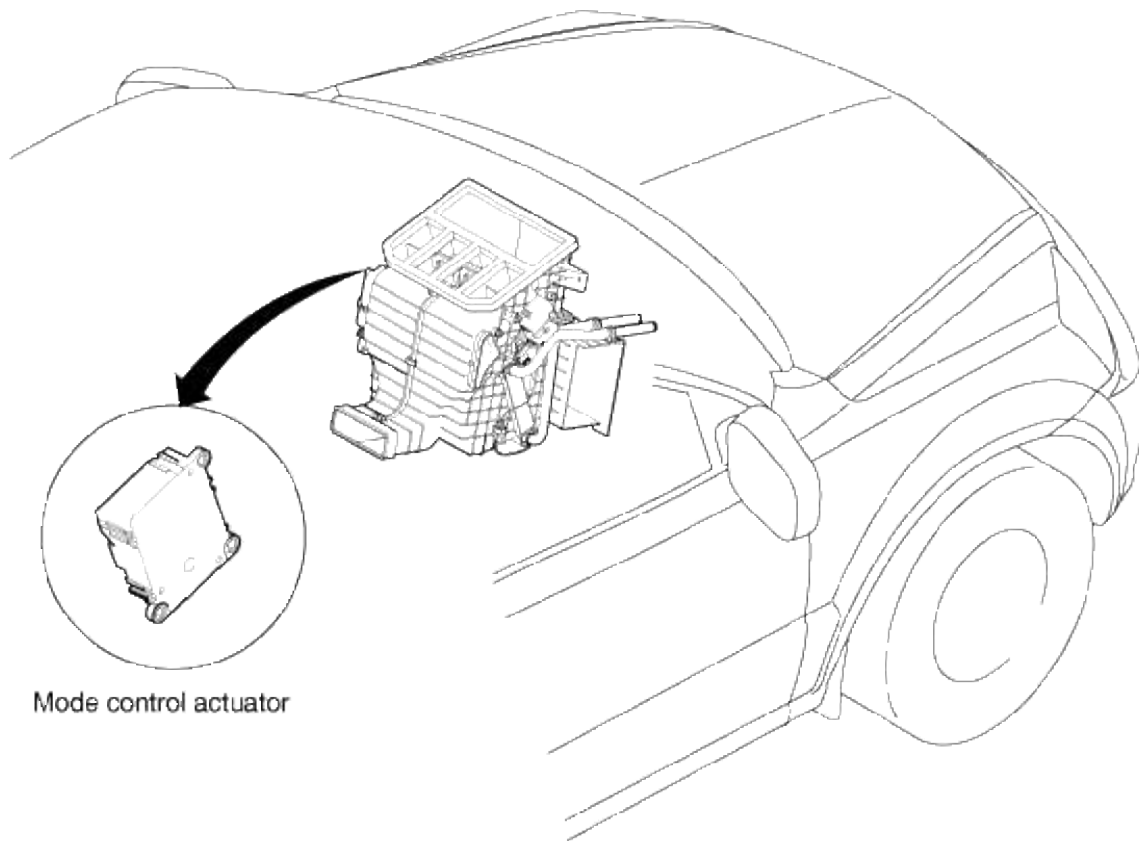
### DESCRIPTION

The mode control actuator is located at the heater unit.

It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

## Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Components and Components Location

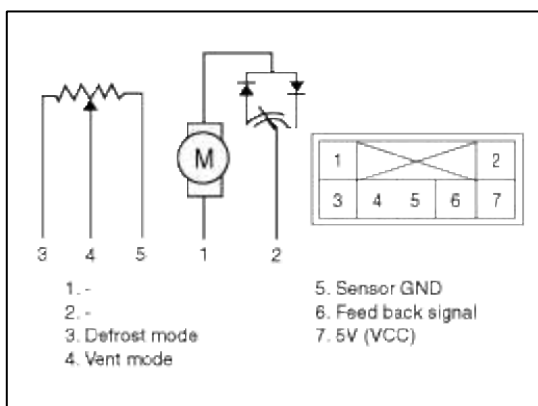
### COMPONENT LOCATION



### Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Repair procedures

#### INSPECTION

1. Ignition "OFF"
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the defrost mode when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse.



5. Check the voltage between terminals 5 and 6.

Door position	Voltage (5-6)	Error detecting
Vent	$0.3 \pm 0.15V$	Low voltage : 0.1V or less
Defrost	$4.7 \pm 0.15V$	High voltage : 4.9V or more

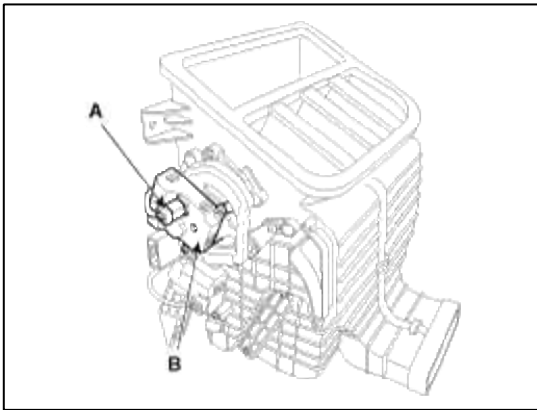
It will feedback current position of actuator to controls.

6. If the measured voltage is not specification, substitute with a known-good mode control actuator and check for proper operation.

7. If the problem is corrected, replace the mode control actuator.

## REPLACEMENT

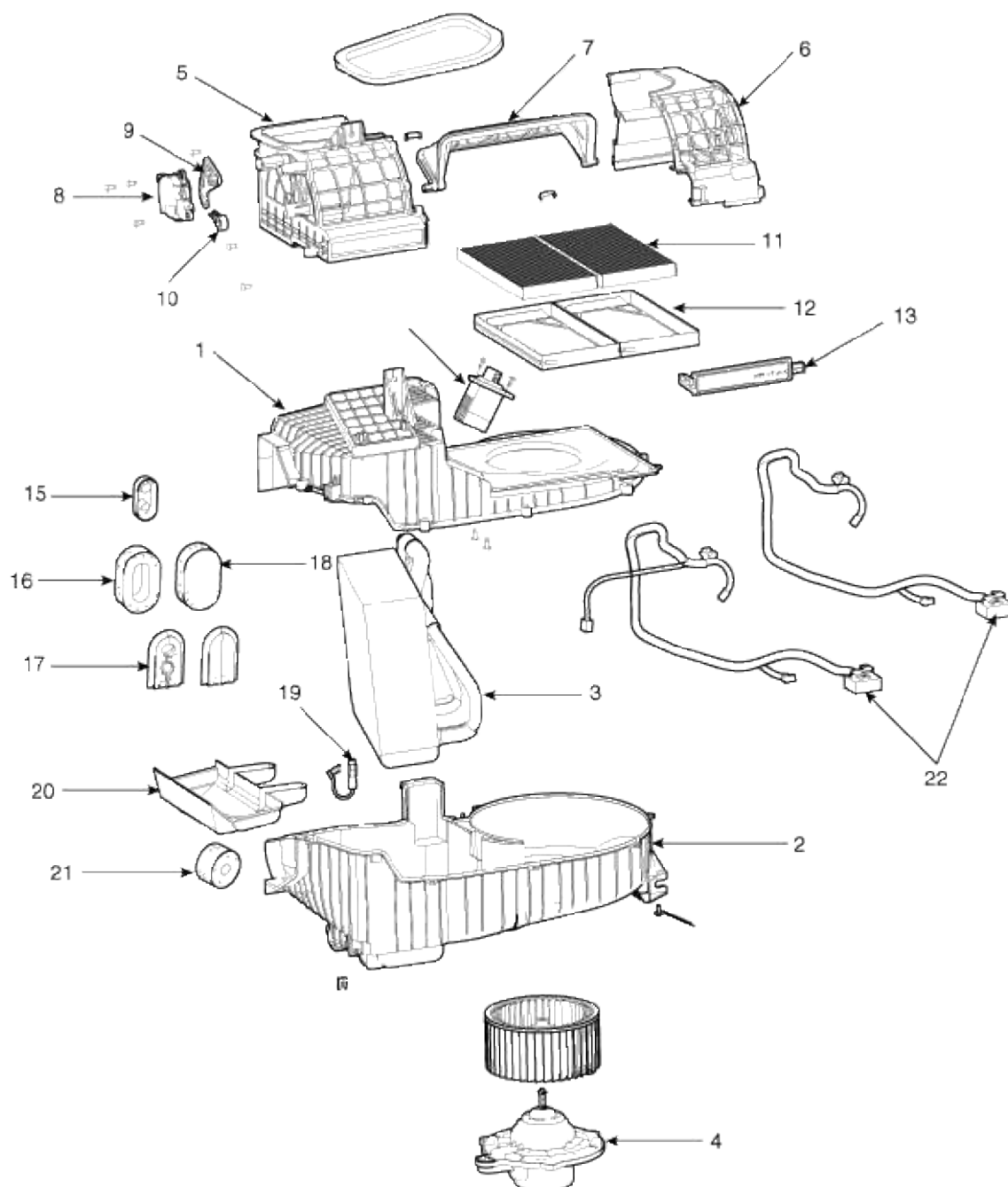
1. Disconnect the negative (-) battery terminal.
2. Remove the driver's crush pad lower panel. (Refer to BD group -Crash pad).
3. Disconnect the mode control actuator connector(A) after removing the air duct.
4. Loosen the mounting screws and then remove the mode control actuator (B).



5. Installation is the reverse order of removal.

**Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Components and Components Location**

## COMPONENTS



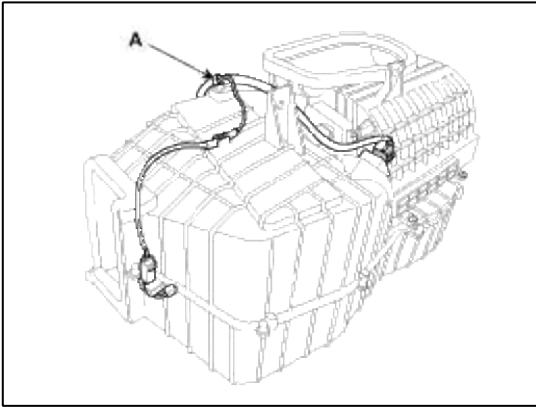
- |                                   |                                      |                          |
|-----------------------------------|--------------------------------------|--------------------------|
| 1. Evaporator & Blower upper case | 9. Intake actuator                   | 17. Evaporator pipe seal |
| 2. Evaporator & Blower lower case | 10. Intake door lever                | 18. Flange seal          |
| 3. Evaporator core                | 11. Climate control air filter       | 19. Evaporator sensor    |
| 4. Blower motor                   | 12. Filter case                      | 20. Matching lining      |
| 5. Intake case (L)                | 13. Climate control air filter cover | 21. Drain seal           |
| 6. Intake case (R)                | 14. Power mosfet                     | 22. Lower lining case    |
| 7. Intake door                    | 15. Flange cap                       | 23. Wire haness          |
| 8. Intake actuator                | 16. Flange seal                      |                          |

## Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Repair procedures

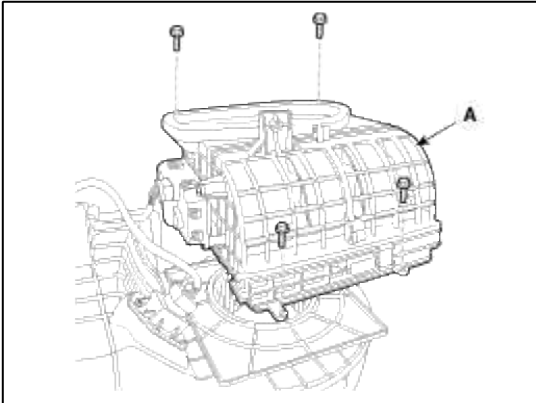
### REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crush pad.(Refer to BD group-crash pad)
3. Remove the cowl cross bar assembly.(Refer to BD group-Crash pad)
4. Remove the evaporator & blower unit.

5. Disconnect the connectors from the intake actuator, the blower motor and power mosfet.

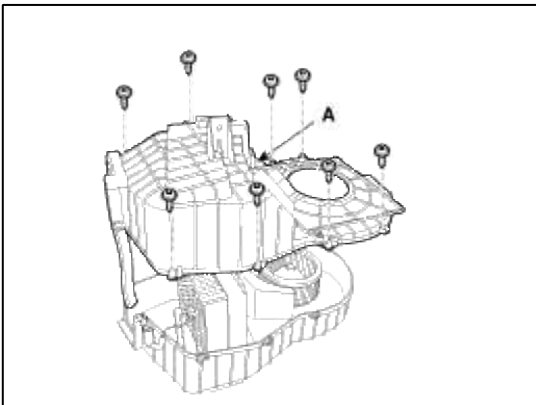


6. Remove the intake duct assembly (A) from the heater unit after loosening a mounting bolt and 4 screws.

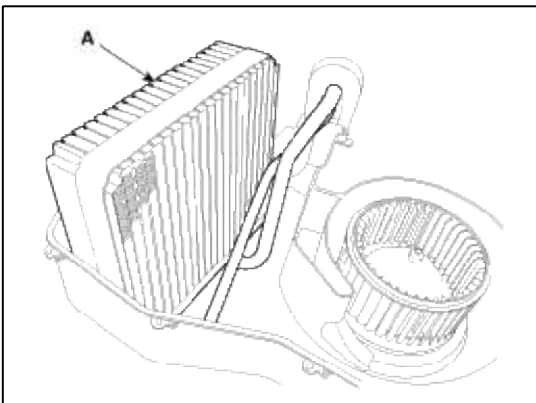
**NOTE**

Make sure that there is no air leaking out of the blower and duct joints.

7. Remove the lower case(A) from the evaporator & blower unit assembly after unscrewing 8screws.



8. Remove the evaporator core(A).

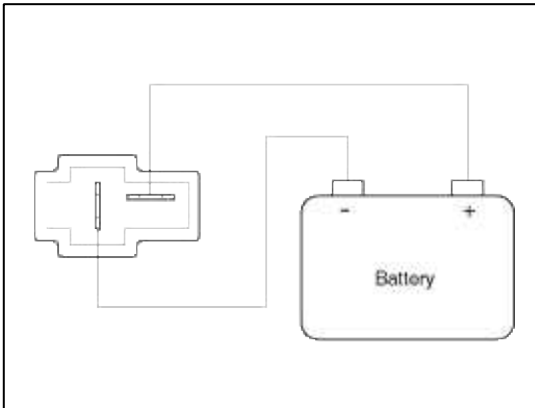


9. Installation is the reverse order of removal.

## Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Description and Operation

### INSPECTION

1. Connect the battery voltage and check the blower motor rotation.

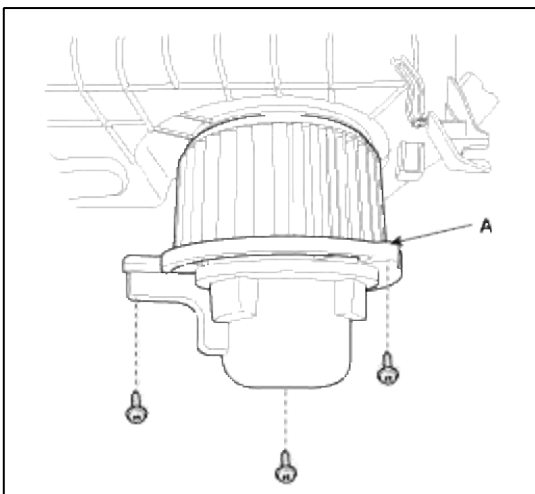


2. If the blower motor voltage is not operated well, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

## Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Repair procedures

### REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector of the blower motor.
3. Remove the blower motor (A) after loosening the mounting screws.



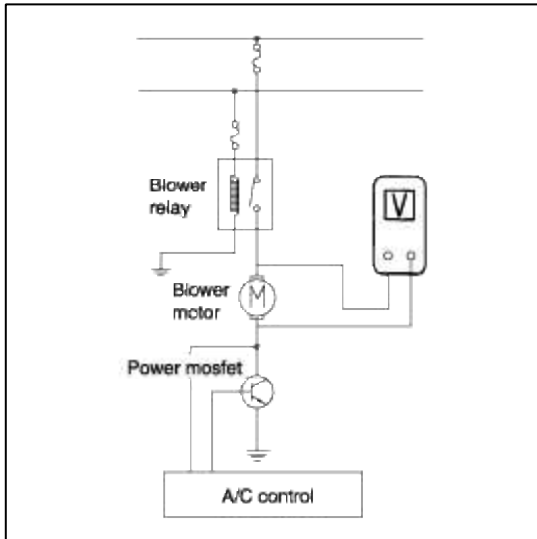
4. Installation is the reverse order of removal.

## Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Description and Operation

### INSPECTION

1. Ignition "ON"
2. Manually operate the control switch and measure the voltage of blower motor.

3. Select the control switch to raise voltage until high speed.



**[Specification]**

Fan	Motor Voltage	
	Manual	AUTO
First speed	$4.0 \pm 0.5$	4.50~4.79
Second speed	$5.0 \pm 0.5$	4.80~5.79
Third speed	$6.2 \pm 0.5$	5.80~6.89
Fourth speed	$7.4 \pm 0.5$	6.90~8.09
Fifth speed	$8.6 \pm 0.5$	8.10~9.29
Sixth speed	$9.8 \pm 0.5$	9.30~10.49
Seventh speed	$11.0 \pm 0.5$	10.50~11.99
eighth speed	Battery(+)	Battery(+)

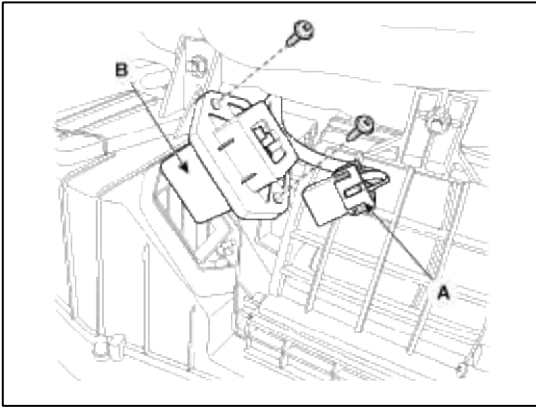
4. If the measured voltage is not specification, substitute with a known-good power mosfet and check for proper operation.
5. If the problem is corrected, replace the power mosfet.

**Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Repair procedures**

**REPLACEMENT**

1. Disconnect the negative (-) battery terminal.
2. Remove the cresh pad.
3. Disconnect the power mosfet connector (A).

4. Remove the power mosfet (B) after loosening the mounting screws.



5. Installation is the reverse order of removal.

### Heating,Ventilation, Air Conditioning > Blower > A/C Air Filter > Description and Operation

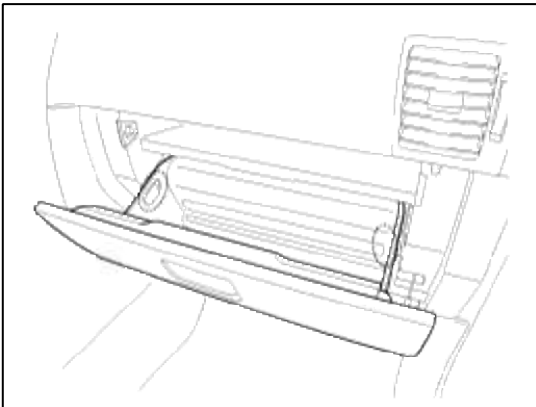
#### DESCRIPTION

This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure comfortable interior environment.

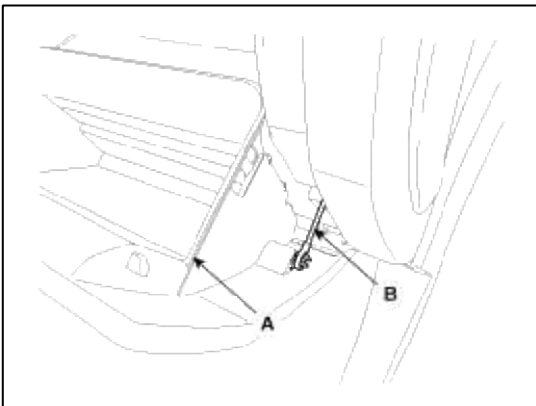
### Heating,Ventilation, Air Conditioning > Blower > A/C Air Filter > Repair procedures

#### REPLACEMENT

1. Open the glove box (B). Lower the glove box down completely by removing the glove box stopper (A) to the glove box.

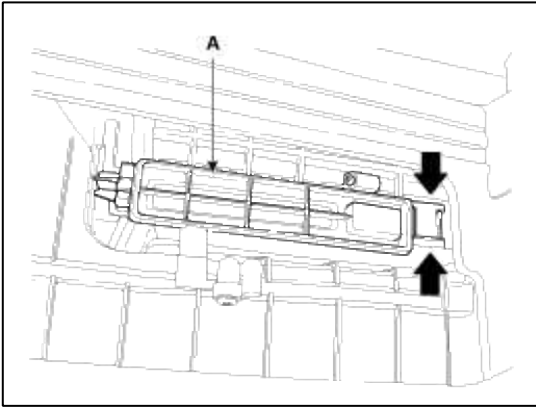


2. Remove the glove box(A) from the lift(B).

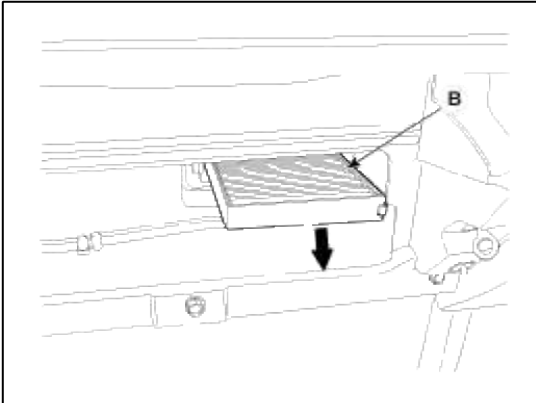




3. Remove the filter cover (A) with pushing the knob.



4. Replace the air filter (B), install it after making sure of the direction of air filter.



#### NOTE

In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

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Replacement period: 15,000 km (9320 mile)

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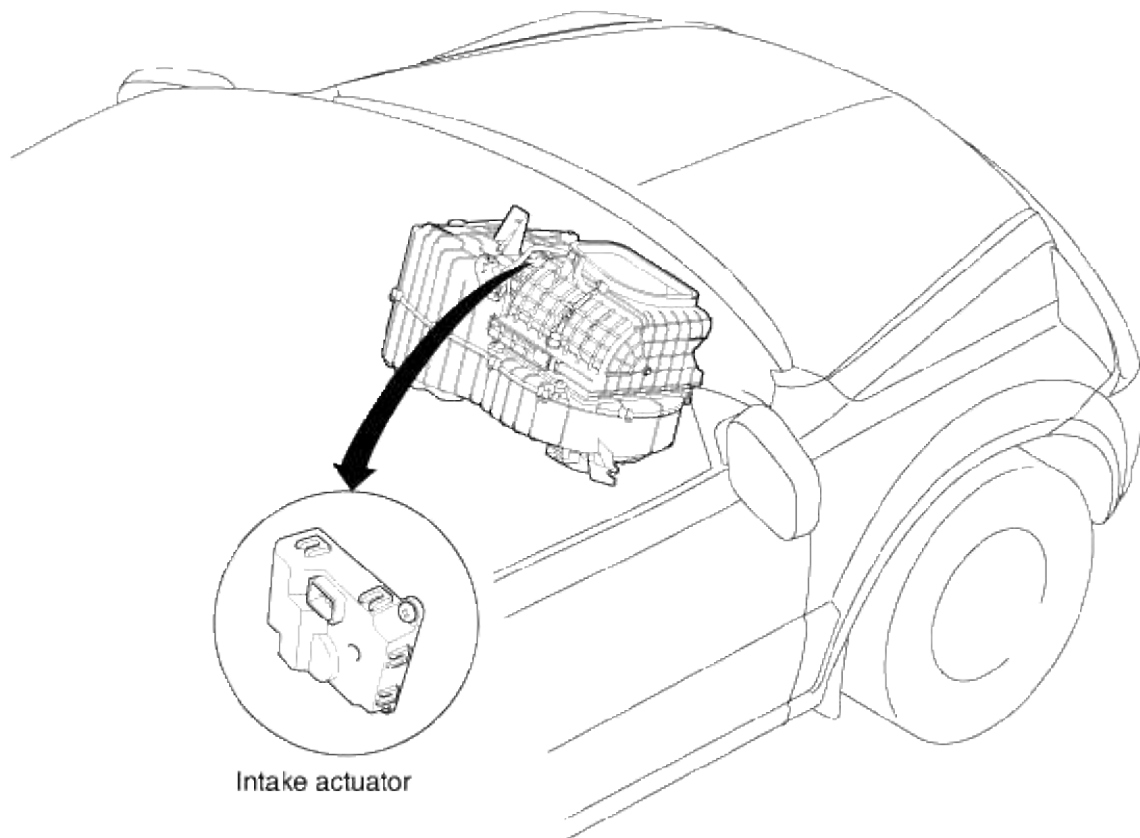
### Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Description and Operation

#### DESCRIPTION

1. The intake actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

### Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Components and Components Location

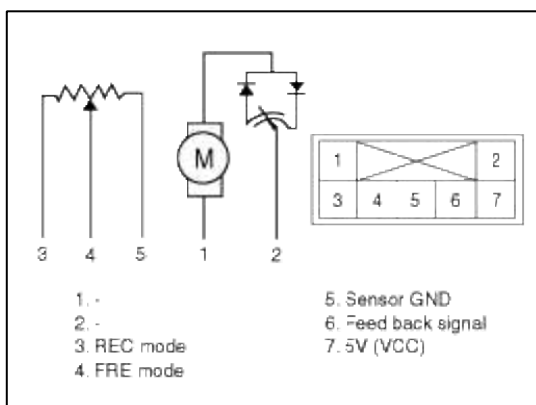
#### COMPONENT LOCATION



### Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Repair procedures

#### INSPECTION

1. Ignition "OFF"
2. Disconnect the intake actuator connector.
3. Verify that the actuator operates to the recirculation position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the intake actuator operates to the fresh position when connecting in the reverse.

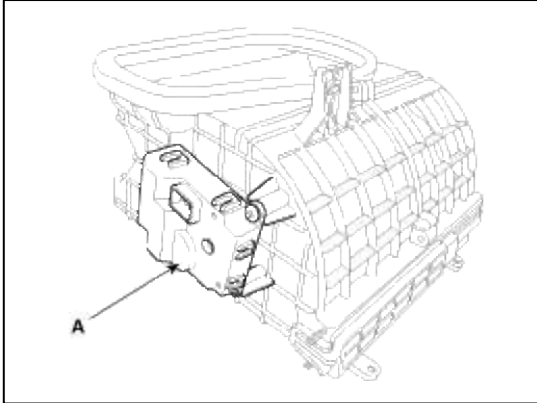


5. If the intake actuator is not operated well, substitute with a known-good intake actuator and check for proper operation.

6. If the problem is corrected, replace the intake actuator.

## REPLACEMENT

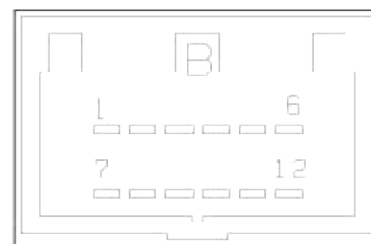
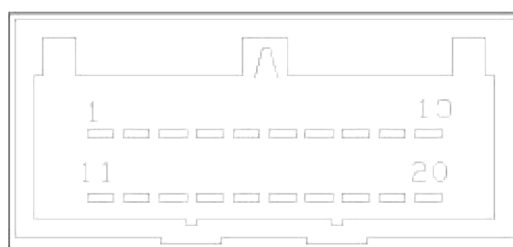
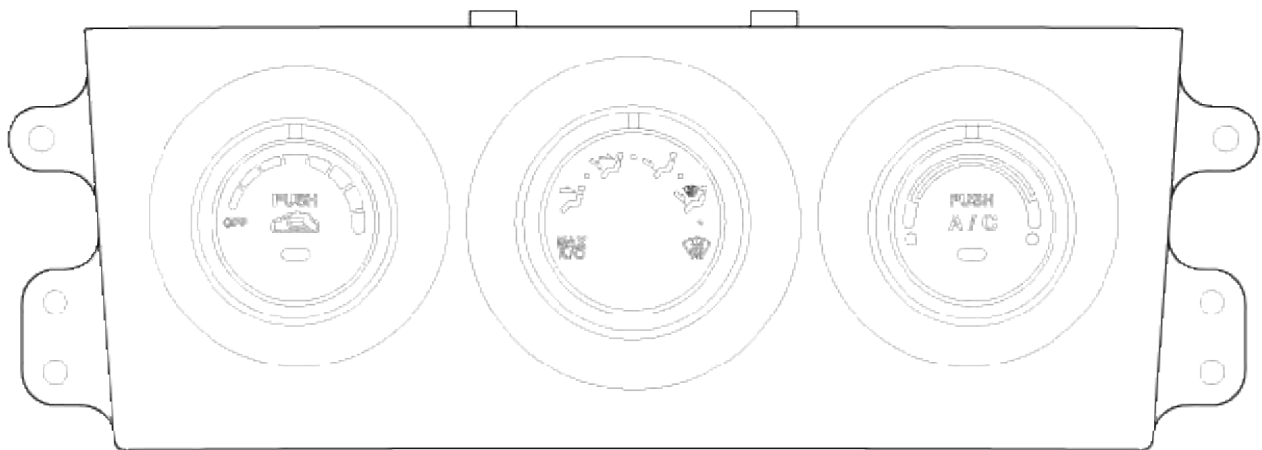
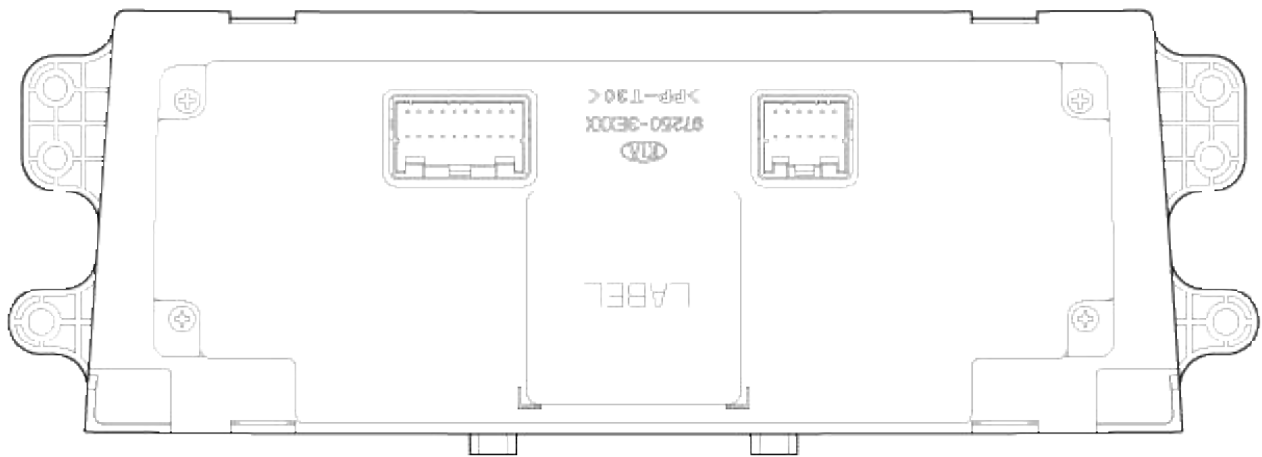
1. Disconnect the negative (-) battery terminal.
2. Remove the cresh pad (Refer to BD group-cresh pad).
3. Disconnect the intake actuator connector.
4. Loosen the mounting screw and then remove the intake actuator (A) from the blower unit.



5. Installation is the reverse order of removal.

**Heating,Ventilation, Air Conditioning > Blower > Control Panel > Components and Components Location**

## COMPONENT



[CONNECTOR PIN FUNCTION]

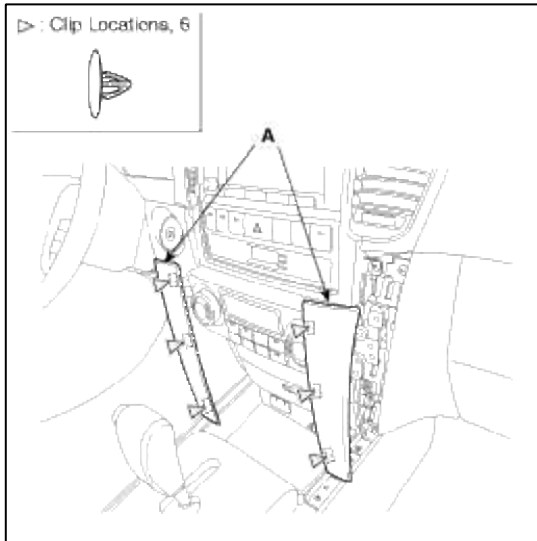
CONNECTOR	PIN	FUNCTION	CONNECTOR	PIN	FUNCTION
Connector(A)	1	IGN2	Connector(B)	1	Vref(5V)
	2	TAIL LAMP		2	A/C SELECTOR (HIGH)
	3	BATT(12V)		3	A/C OUTPUT(HIGH)
	4	FET(G)		4	TEMP ACTUATOR(F/BACK)
	5	BLOWER MOTOR		5	MODE ACTUATOR(F/BACK)
	6	-		6	INTAKE ACTUATOR(F/BACK)
	7	TEMP ACTUATOR(COOL)		7	IGN2
	8	INTAKE ACTUATOR(FRE)		8	-
	9	RHEOSTAT		9	-
	10	GND		10	EVAPORATOR SENSOR
	11	-		11	SENSOR GND
	12	MODE ACTUATOR(DEF)		12	GND
	13	FET(D)			
	14	-			
	15	-			
	16	-			
	17	MODE ACTUATOR(VENT)			
	18	TEMP ACTUATOR(WARM)			
	19	INTAKE ACTUATOR(REC)			
	20	BLOWER SELECTOR			

### Heating,Ventilation, Air Conditioning > Blower > Control Panel > Repair procedures

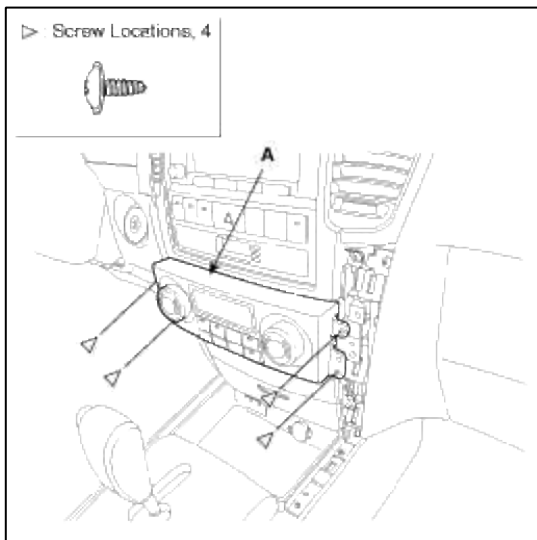
#### REPLACEMENT

1. Disconnect the negative (-) battery terminal.

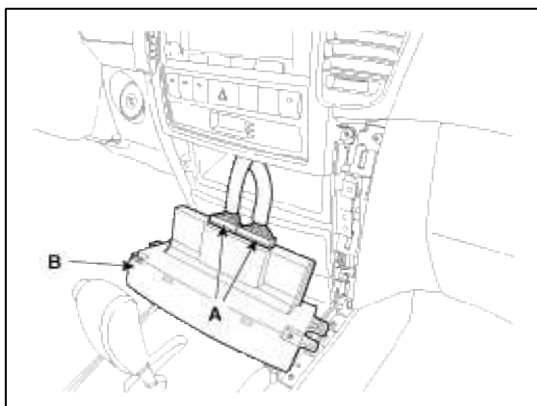
2. Remove the side garnish (A).



3. After loosening the heater control mounting screw, remove the heater control unit(A).



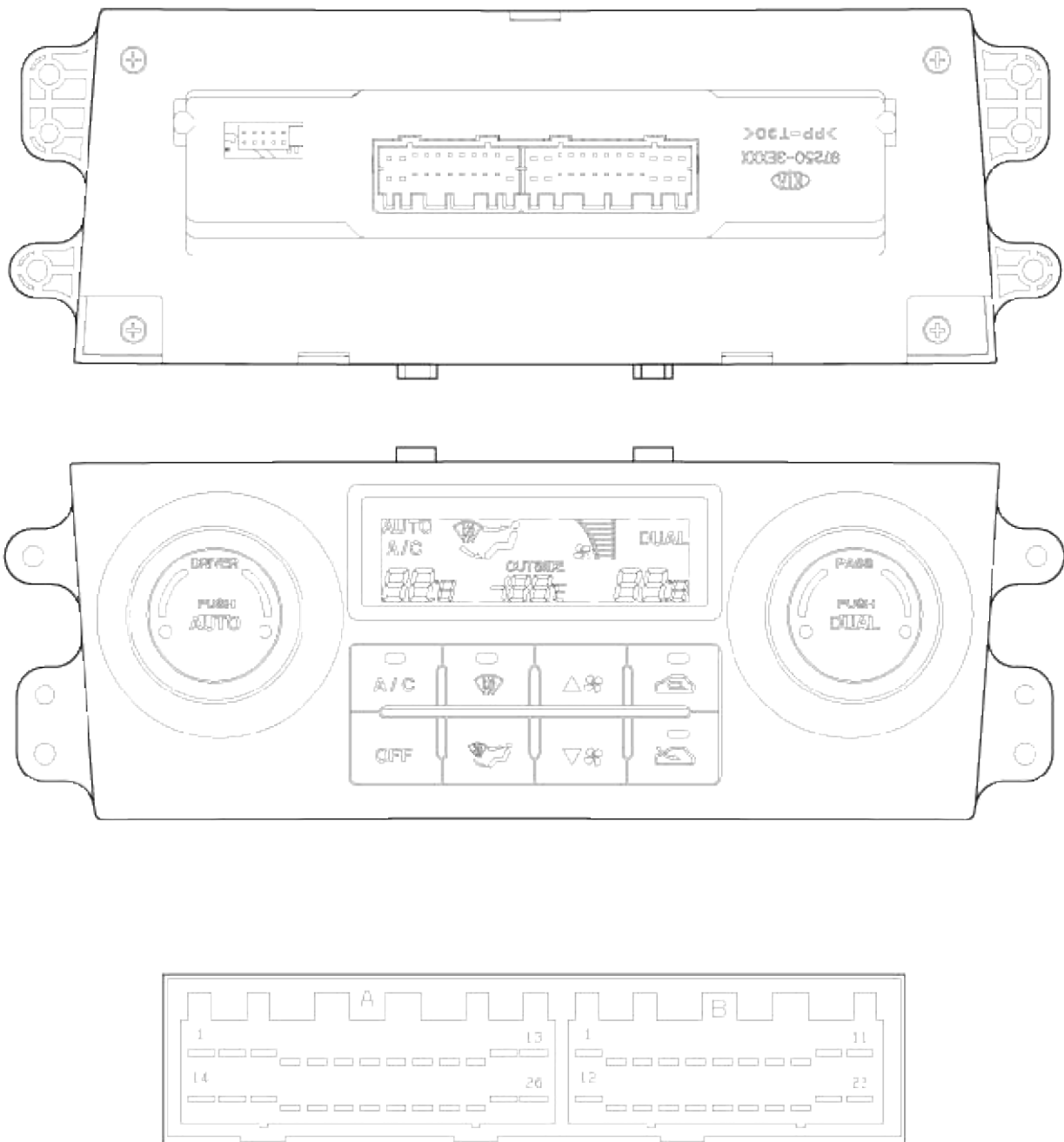
4. After disconnect the connector(A), remove the heater control unit(B).



5. Installation is the reverse order of removal.

**Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Components and Components Location**

COMPONENT



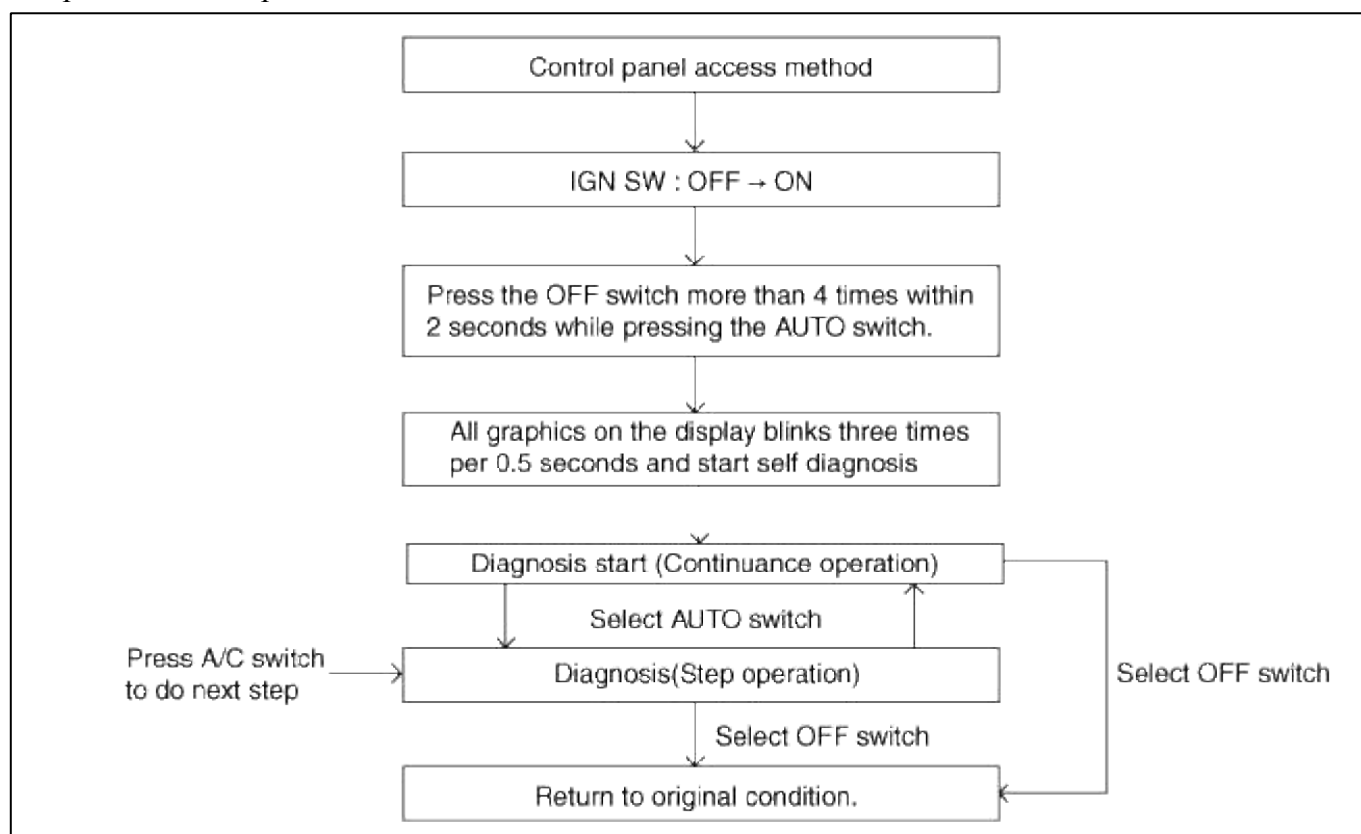
### [CONNECTOR PIN FUNCTION]

CONNECTOR	PIN	FUNCTION	CONNECTOR	PIN	FUNCTION
CONNECTOR (A)	1	IGN2	CONNECTOR (B)	1	REF(+5V)
	2	TAIL LAMP		2	IG2
	3	Battery (+)		3	SUN SENSOR(+)
	4	Power mosfet (Gate)		4	EVAPORATOR SENSOR
	5	BLOWER MOTOR		5	SPEED SENSOR
	6	-		6	K-LINE
	7	INCAR MOTOR(+)		7	HUMIDIT SENSOR
	8	PS TEMP ACTUATOR(COOL)		8	INCAR SENSOR
	9	DR TEMP ACTUATOR(COOL)		9	-
	10	INTAKE ACTUATOR(FRESH)		10	DR TEMP ACTUATOR F/B
	11	-		11	MODE ACTUATOR F/B
	12	RHEOSTAT		12	AMB SENSOR
	13	GND		13	DR SUN SENSOR(-)
	14	A/C SELECT(HIGH)		14	WATER TEMP SENSOR
	15	MODE ACTUATOR(DEF)		15	INTAKE ACTUATOR F/B
	16	FET(DRAIN)		16	PS TEMP ACTUATOR F/B
	17	A/C THERMO(HIGH)		17	PS SUN SENSOR (-)
	18	-		18	PS TEMP ACTUATOR(WARM)
	19	-		19	-
	20	-		20	-
	21	MODE ACTUATOR(VENT)		21	GND
	22	DR TEMP ACTUATOR(WARM)		22	SENSOR GND
	23	INTAKE ACTUATOR(REC)			
	24	BLOWER SELECT(LOW)			
	25	INCAR MOTOR(-)			
	26	-			



## 1. Self-diagnosis process

The F.A.T.C. module self test feature will detect electrical malfunction and provide error codes for system components with suspected failures.



### NOTE

DTC data can be retrieved from the control panel directly or from the DLC using the Hi-Scan Pro.

## 2. How to read self-diagnostic code

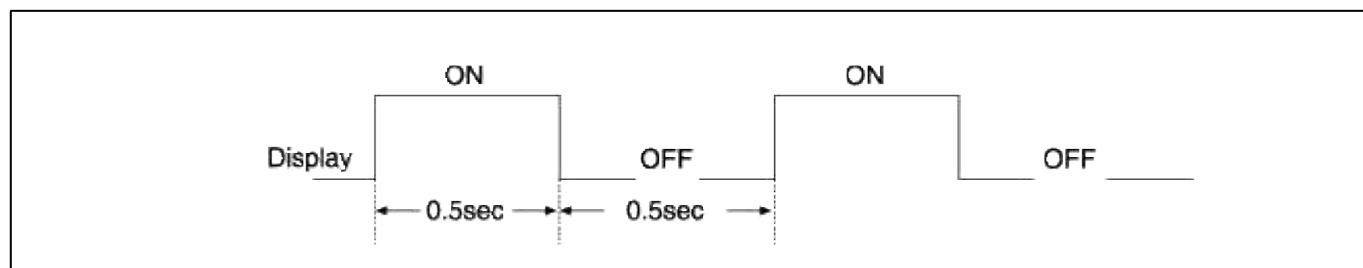
After the display panel flickers three times every 0.5 second, the corresponding fault code flickers on the setup temperature display panel every 0.5 second and will show two figures. Codes are displayed in numerical format

### Fault code

Fault code	Fail description
Control unit	
0	Normal
11	INCAR TEMPERATURE SENSOR OPEN (High)
12	INCAR TEMPERATURE SENSOR SHORT (Low)
13	AMBIENT TEMPERATURE SENSOR OPEN (High)
14	AMBIENT TEMPERATURE SENSOR SHORT (Low)
15	WATER TEMPERATURE SENSOR OPEN (High)
16	WATER TEMPERATURE SENSOR SHORT (Low)
17	EVAPORATOR TEMPERATURE SENSOR OPEN (High)
18	EVAPORATOR TEMPERATURE SENSOR SHORT (Low)
19	TEMP POTENTIOMETER OPEN or SHORT (Drive)
20	TEMP POTENTIOMETER FAULT (Drive)
21	MODE POTENTIOMETER OPEN or SHORT

22	MODE POTENTIOMETER FAULT
23	HUMIDITY SENSOR OPEN (Open)
24	HUMIDITY SENSOR SHORT (Short)
25	INTAKE POTENTIOMETER OPEN or SHORT
26	INTAKE POTENTIOMETER FAULT
32	TEMP POTENTIOMETER OPEN or SHORT (Passenger)
33	TEMP POTENTIOMETER FAULT (Passenger)

### 3. Fault code display.



4. If fault codes are displayed during the check, Inspect malfunction causes by referring to fault codes.

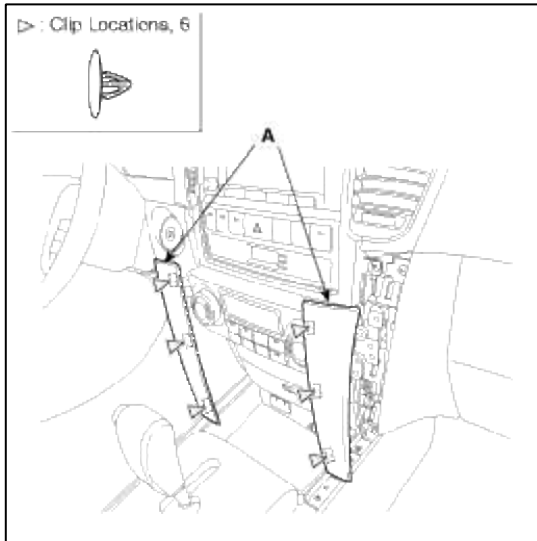
### 5. Fail safe

- (1) In-car temperature sensor: Control with the value of 25°C (77°F)
- (2) Ambient temperature sensor: Control with the value of 20°C (67°F)
- (3) Evaporator temperature sensor: Control with the value of -2°C (28.4°F)
- (4) Humidity sensor: Doesn't control.
- (5) Photo sensor: None correction
- (6) Temperature control actuator (Air mix potentiometer):
  - A. If temperature set 17°C-24.5°C, fix at maximum cooling position.
  - B. If temperature set 25°C-32°C, fix at maximum heating position.
- (7) Mode control actuator (Direction potentiometer):
  - A. Fix vent position, while selecting vent mode.
  - B. Fix defrost position, while selecting all except vent mode.

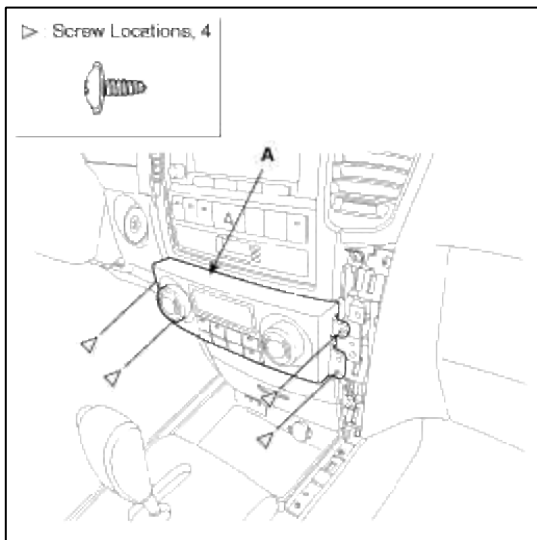
## REPLACEMENT

1. Disconnect the negative (-) battery terminal.

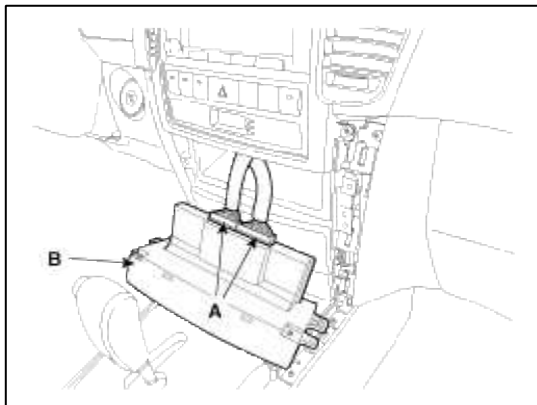
2. Remove the side garnish (A).



3. After loosening the heater control mounting screw, remove the heater control unit(A).



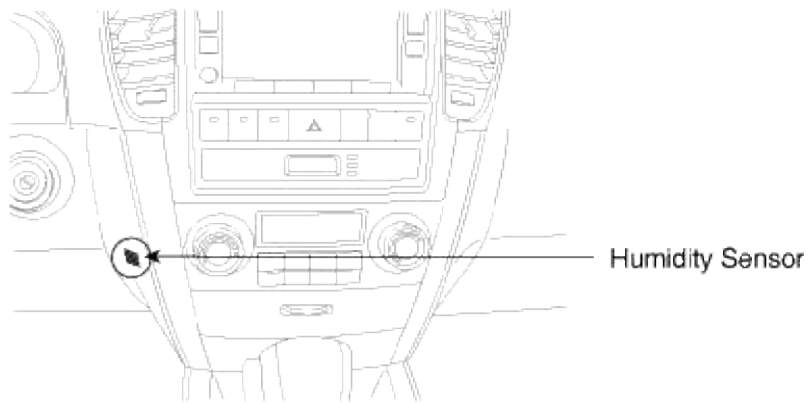
4. After disconnect the connector(A), remove the heater control unit(B).



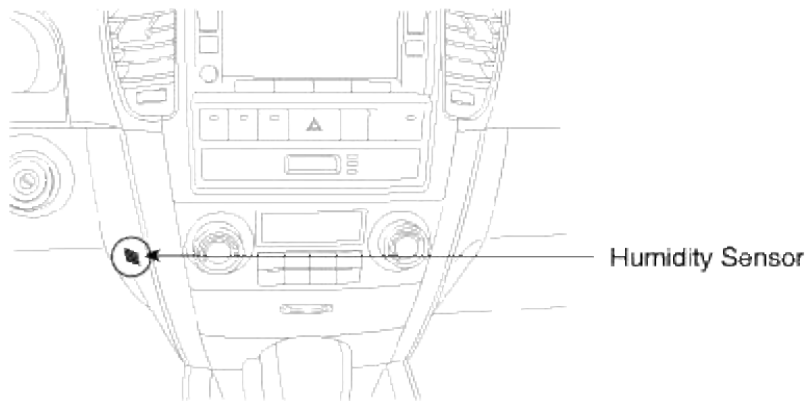
5. Installation is the reverse order of removal.

**Heating,Ventilation, Air Conditioning > Troubleshooting > B1200**

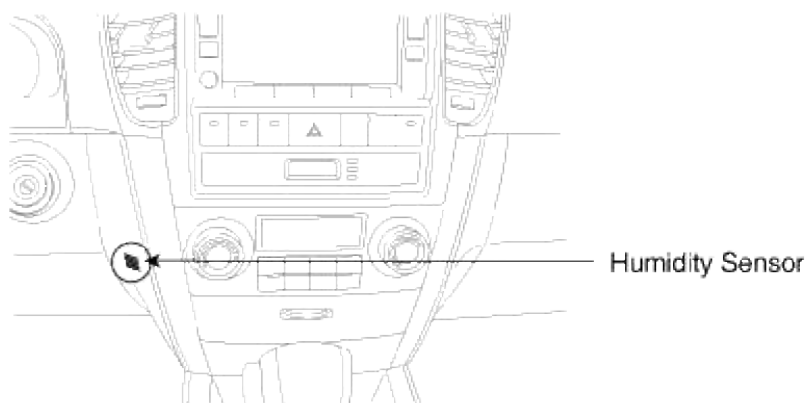
COMPONENT LOCATION



#### COMPONENT LOCATION



#### COMPONENT LOCATION



#### GENERAL DESCRIPTION

Humidity sensor located at crush pad, detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity for preventing in-car fogging. Air conditioner operation depends on ambient temperature and humidity.

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#### DTC DESCRIPTION

The A/C controller sets DTC B1200 if there is an open circuit in humidity sensor signal harness or the measured frequency value of sensor is more than threshold value(about 7,100Hz)

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Frequency check	<ul style="list-style-type: none"> <li>• Open Circuit in signal harness</li> <li>• Faulty Humidity Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• > 7,100 Hz	
Detecting time	• 10msec	
FAIL SAFE	• Control with the value of 10%	

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Item	Detecting Condition	Possible cause
DTC Strategy	• Frequency check	<ul style="list-style-type: none"> <li>• Open Circuit in signal harness</li> <li>• Faulty Humidity Sensor</li> <li>• Faulty A/C control unit</li> </ul>
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Item	Detecting Condition	Possible cause
DTC Strategy	• Frequency check	<ul style="list-style-type: none"> <li>• Open Circuit in signal harness</li> <li>• Faulty Humidity Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• > 7,100 Hz	
Detecting time	• 10msec	
FAIL SAFE	• Control with the value of 10%	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool while drying the humidity sensor with a hair drier or heat gun adjusted to a low heat setting.

1.2 CURRENT DATA	
<b>HUMIDITY SENSOR</b>	<b>10 %</b>
HEATER WATER TEMP.SNSR	12.0 °C
IN-CAR TEMP.SENSOR	11.0 °C
AMBIENT AIR TEMP.SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POSENTIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	89.79 %

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1200 HUMIDITY SENSOR - OPEN(HIGH)</b>	
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
HELP	

Fig. 2

Fig 2 : DTC B1200.

4. Are the DTC B1200 present and is parameter of "Humidity Sensor" fixed?

Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"

3. Monitor the "Humidity Sensor" Parameter on the Scantool while drying the humidity sensor with a hair drier or heat gun adjusted to a low heat setting.

1.2 CURRENT DATA	
<b>HUMIDITY SENSOR</b>	<b>10 %</b>
HEATER WATER TEMP.SNSR	12.0 °C
IN-CAR TEMP.SENSOR	11.0 °C
AMBIENT AIR TEMP.SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POSENTIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	89.79 %
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1200 HUMIDITY SENSOR - OPEN(HIGH)</b>	
<div> <div>NUMBER OF DTC : 1 ITEMS</div> </div>	
<div> <div>PART</div> <div>ERAS</div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B1200.

4. Are the DTC B1200 present and is parameter of "Humidity Sensor" fixed?

Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

#### MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool while drying the humidity sensor with a hair drier or heat gun adjusted to a low heat setting.

1.2 CURRENT DATA	
<b>HUMIDITY SENSOR</b>	<b>10 %</b>
HEATER WATER TEMP.SNSR	12.0 °C
IN-CAR TEMP.SENSOR	11.0 °C
AMBIENT AIR TEMP.SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POSENTIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	89.79 %
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1200 HUMIDITY SENSOR - OPEN(HIGH)</b>	
<div> <div>NUMBER OF DTC : 1 ITEMS</div> </div>	
<div> <div>PART</div> <div>ERAS</div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B1200.

## 4. Are the DTC B1200 present and is parameter of "Humidity Sensor" fixed?

Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

## 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## 3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

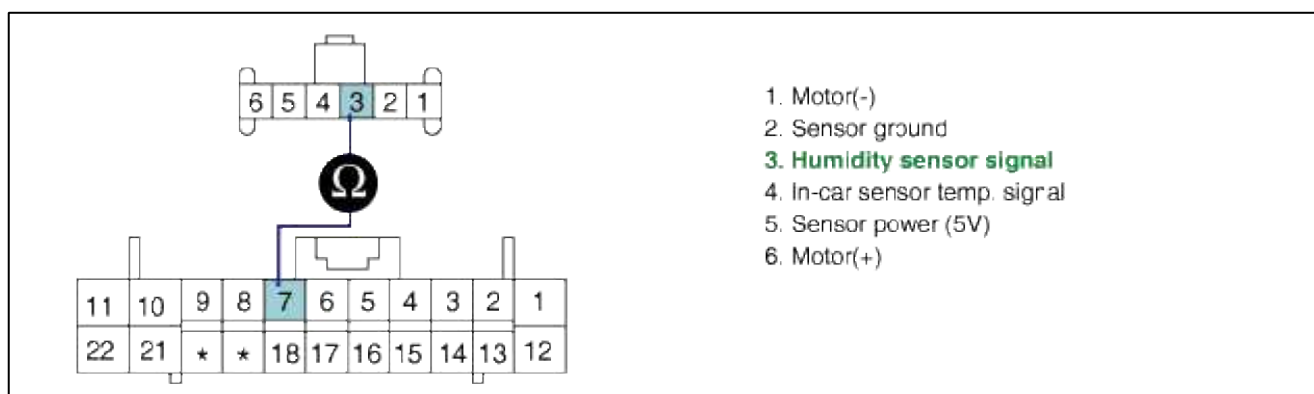
## 1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Humidity Sensor.

(3) Measure resistance between terminal "3" of Humidity Sensor and terminal "7" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION



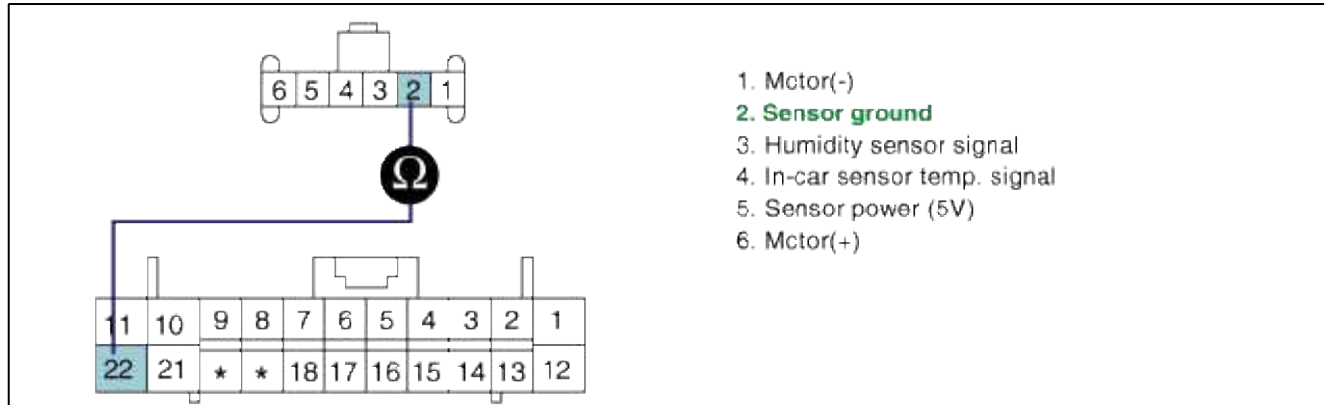
1. Check for open in ground harness.

(1) Ignition "OFF"

(2) Disconnect Humidity Sensor.

(3) Measure resistance between terminal "2" of Humidity Sensor and terminal "22" of A/C Control Unit.

Specification :Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

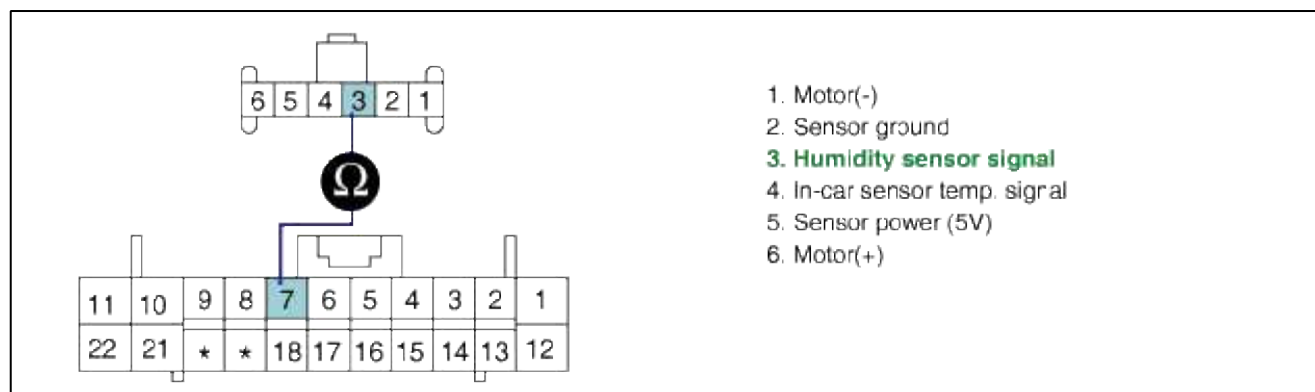
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Humidity Sensor.
  - (3) Measure resistance between terminal "3" of Humidity Sensor and terminal "7" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

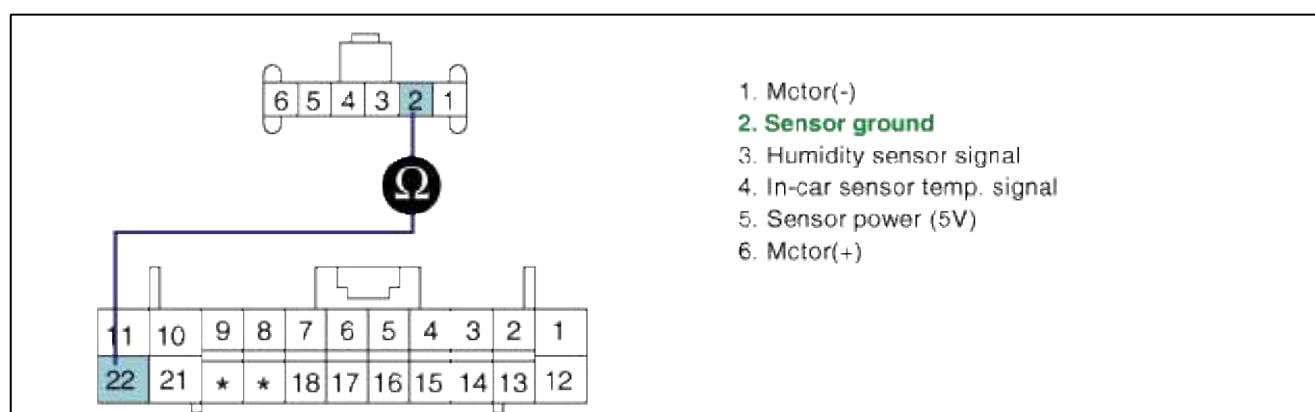
**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Humidity Sensor.
  - (3) Measure resistance between terminal "2" of Humidity Sensor and terminal "22" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

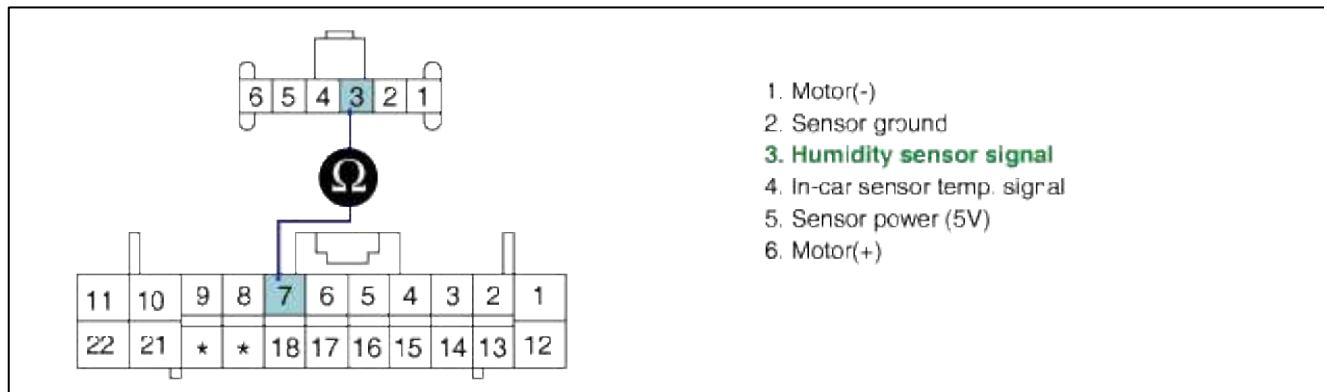
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Humidity Sensor.
  - (3) Measure resistance between terminal "3" of Humidity Sensor and terminal "7" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

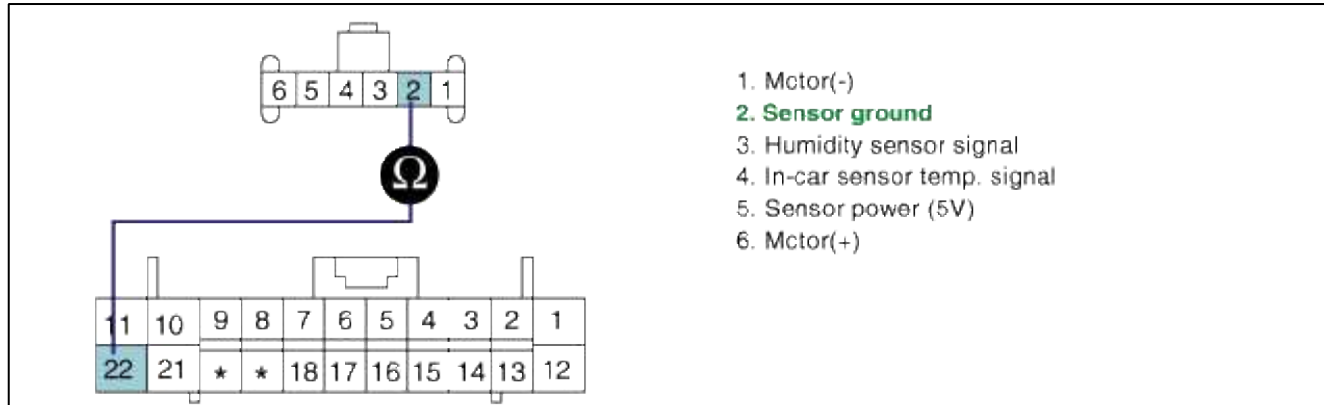
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## 1. Check for open in ground harness.

(1) Ignition "OFF"

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(3) Measure resistance between terminal "2" of Humidity Sensor and terminal "22" of A/C Control Unit.

Specification : Approx. 0  $\Omega$ 

(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

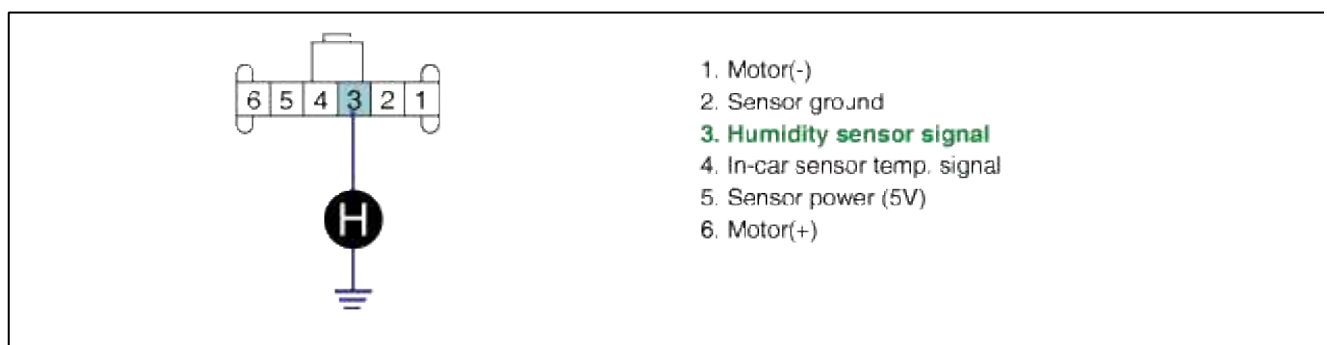
## 1. Check Humidity Sensor.

(1) Engine "ON"

(2) Connect Humidity Sensor.

(3) Measure Frequency between terminal "3" of Humidity sensor while increasing humidity.

Specification : Refer the specifications in fig 5.



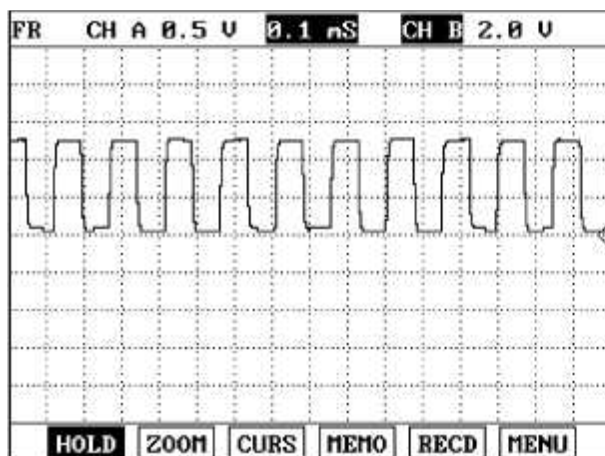


Fig. 3

Fig 3 : Signal waveform of Humidity sensor.

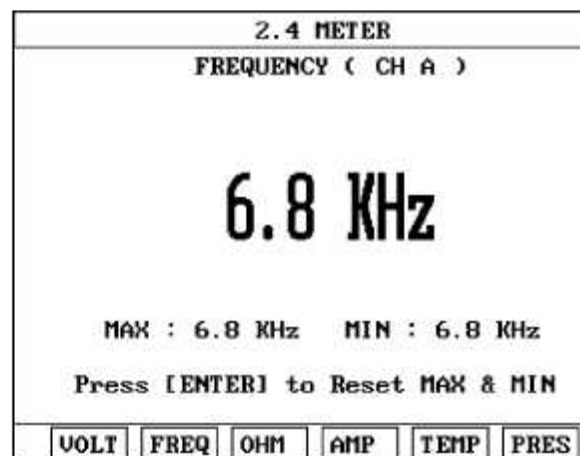


Fig. 4

Fig 4 : Frequency of Humidity sensor Measured by scantool.

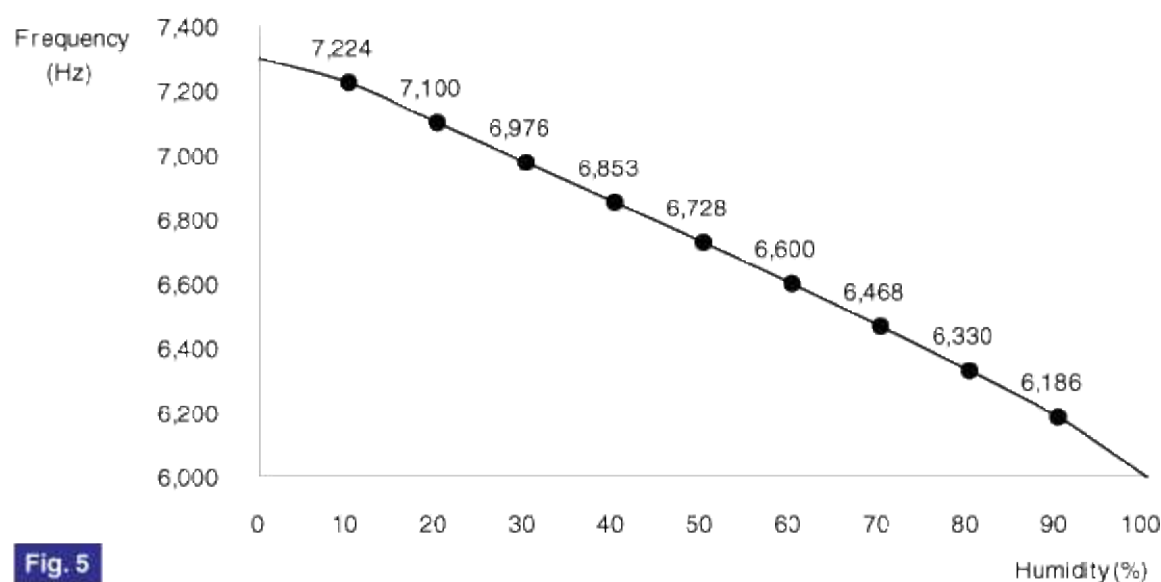


Fig. 5

Fig 5) Specifications : Frequency value of humidity sensor as a function of Relative humidity.

(4) Is the measured frequency within specifications in fig 5? (tolerance limits  $\pm 5\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

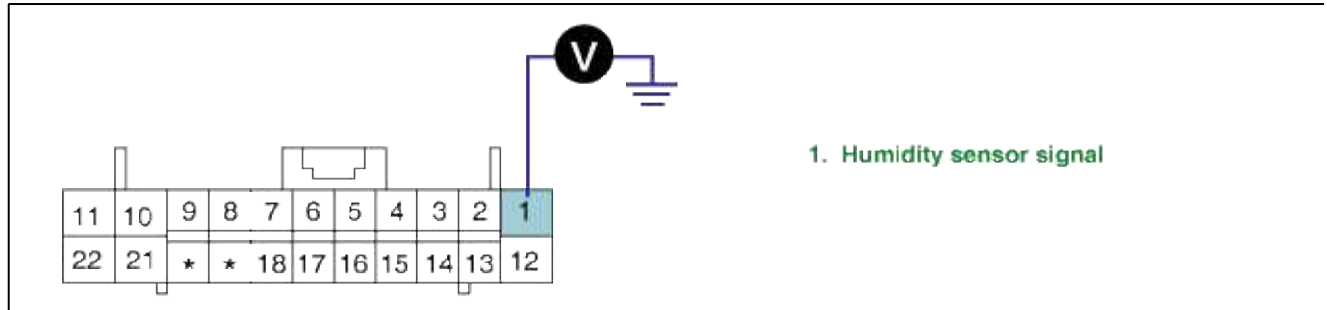
Substitute with a known-good Humidity sensor and check for proper operation.

If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect Humidity Sensor.
- (3) Measure voltage value between terminal "1" of A/C control unit and chassis ground.

Specification : 5V



- (4) Is the measured voltage within specification?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

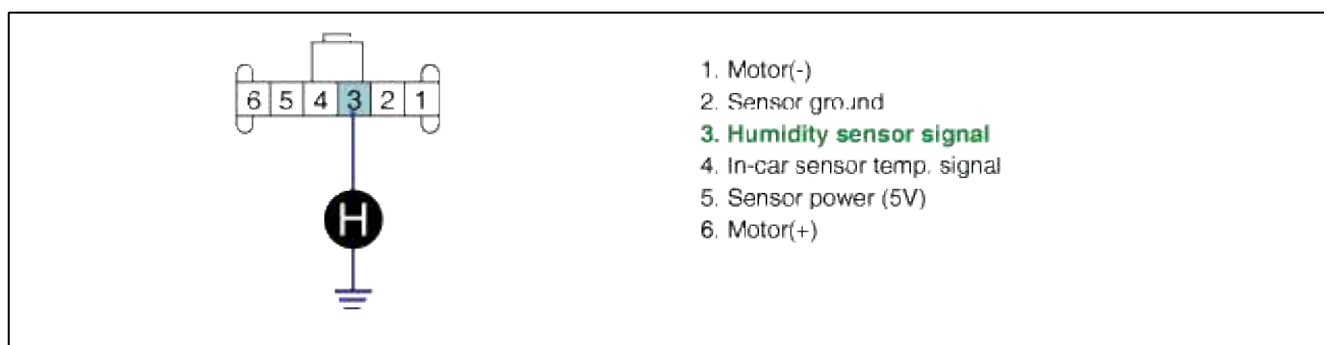
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. Check Humidity Sensor.

- (1) Engine "ON"
- (2) Connect Humidity Sensor.
- (3) Measure Frequency between terminal "3" of Humidity sensor while increasing humidity.

Specification : Refer the specifications in fig 5.



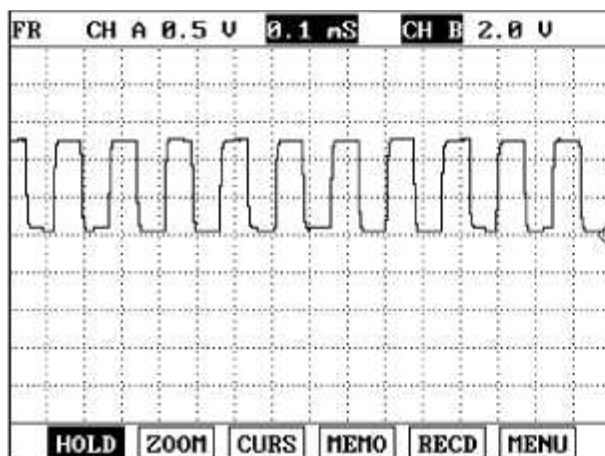


Fig. 3

Fig 3 : Signal waveform of Humidity sensor.

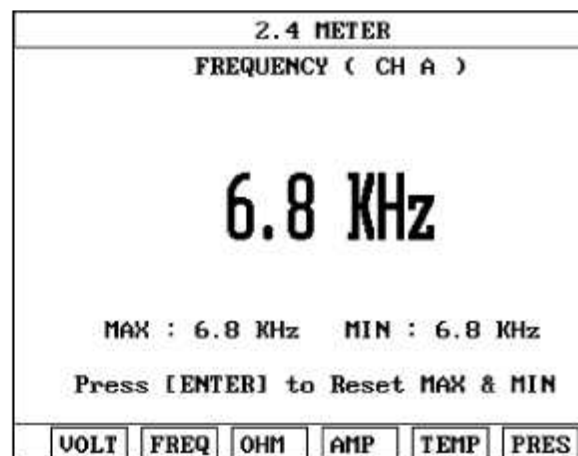


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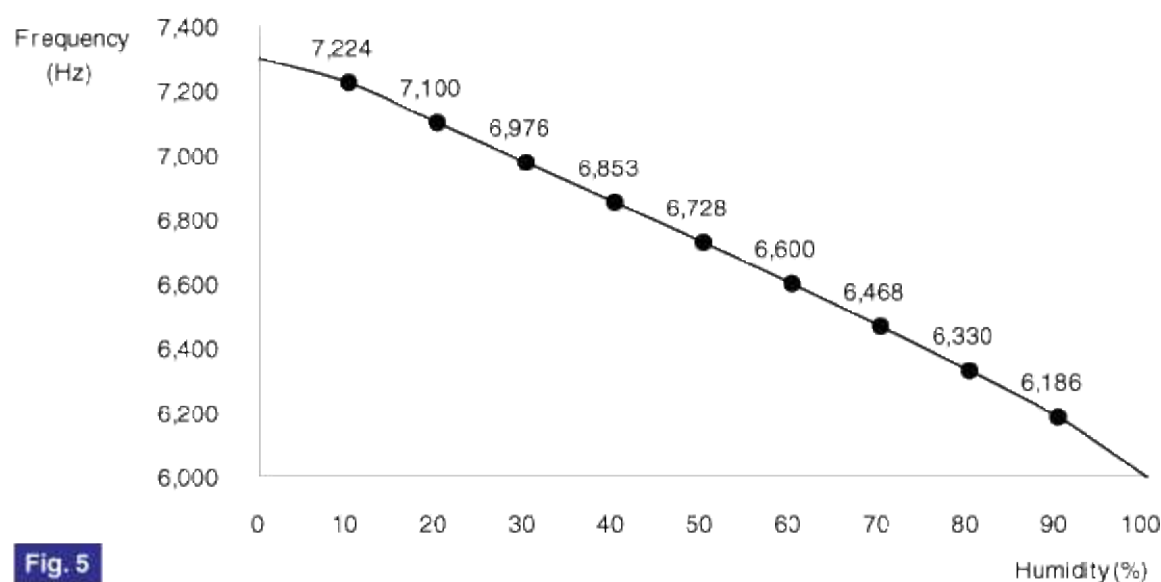


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Go to "Check A/C Control Unit" procedure.

**NO**

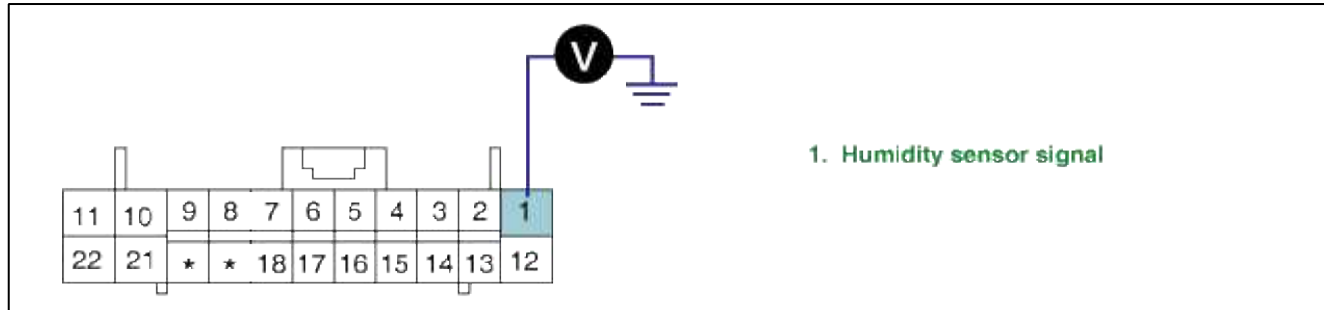
Substitute with a known-good Humidity sensor and check for proper operation.

If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure

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- (1) Engine "ON"
- (2) Disconnect Humidity Sensor.
- (3) Measure voltage value between terminal "1" of A/C control unit and chassis ground.

Specification : 5V



- (4) Is the measured voltage within specification?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

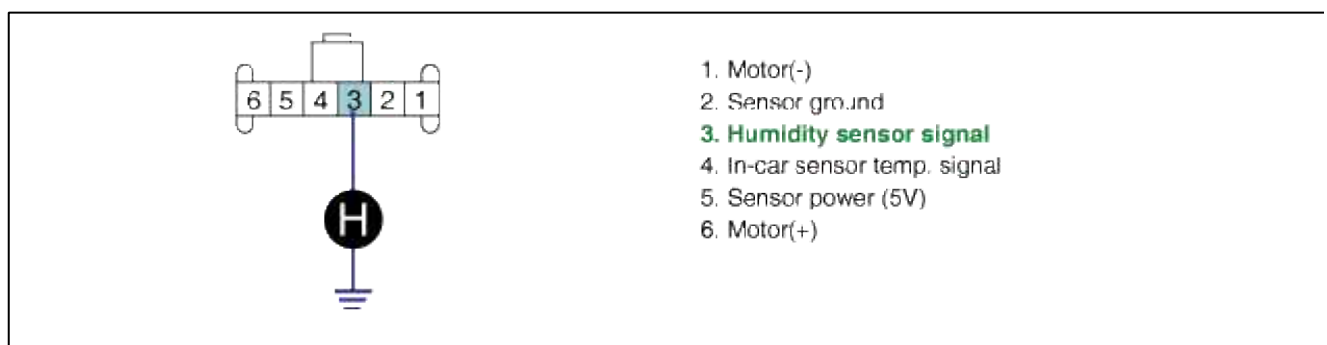
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. Check Humidity Sensor.

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- (2) Connect Humidity Sensor.
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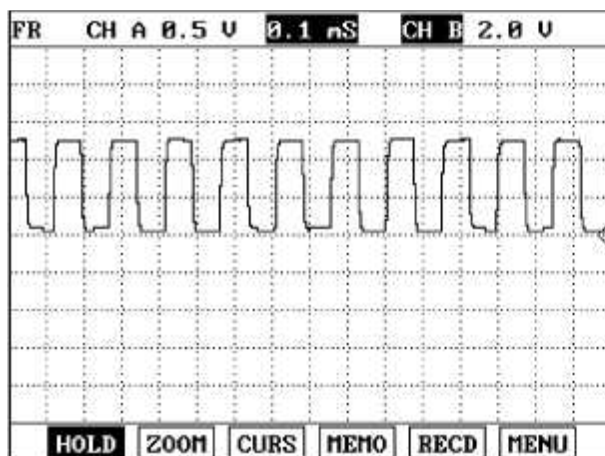


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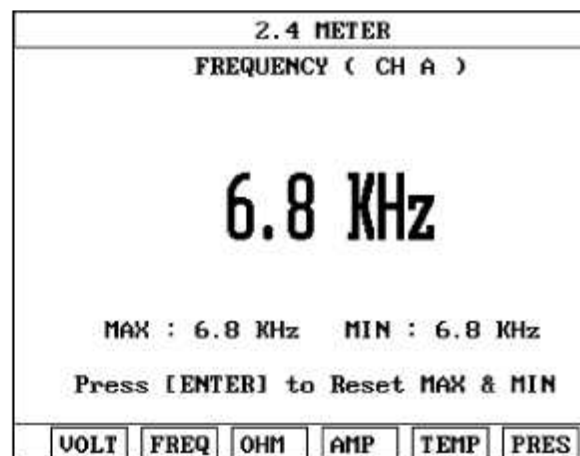


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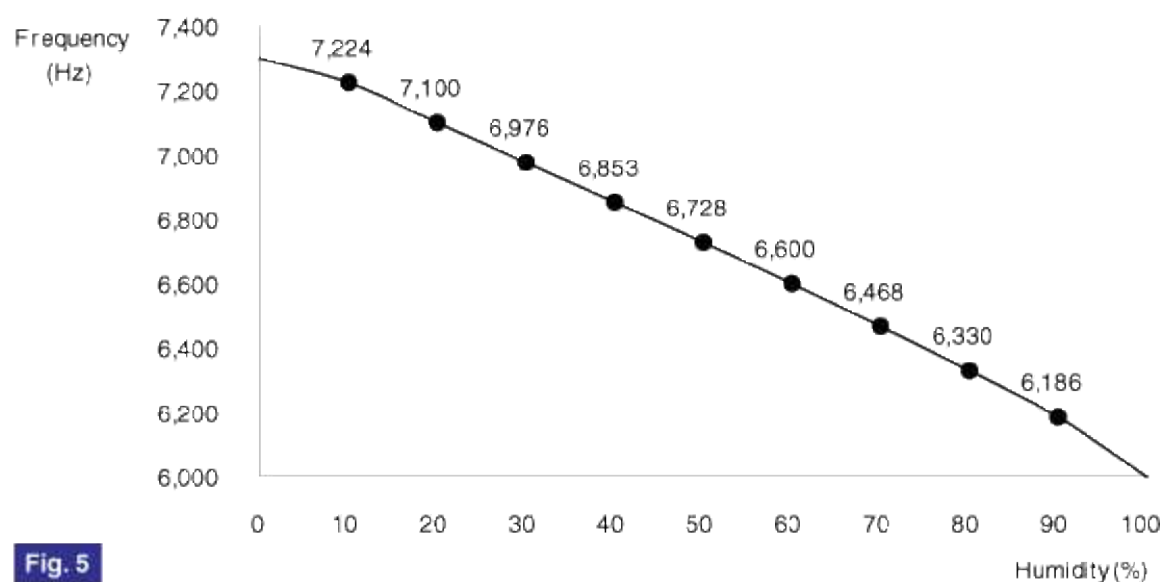


Fig. 5

Fig 5) Specifications : Frequency value of humidity sensor as a function of Relative humidity.

(4) Is the measured frequency within specifications in fig 5? (tolerance limits  $\pm 5\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

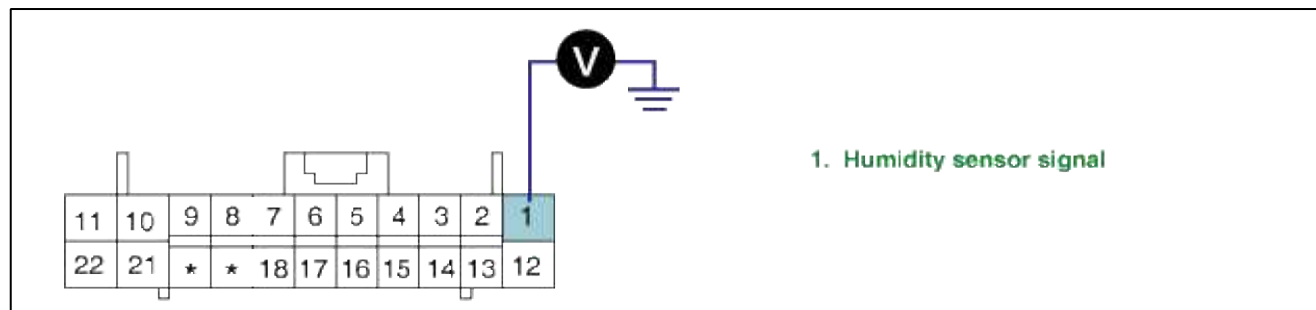
Substitute with a known-good Humidity sensor and check for proper operation.

If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect Humidity Sensor.
- (3) Measure voltage value between terminal "1" of A/C control unit and chassis ground.

Specification : 5V



- (4) Is the measured voltage within specification?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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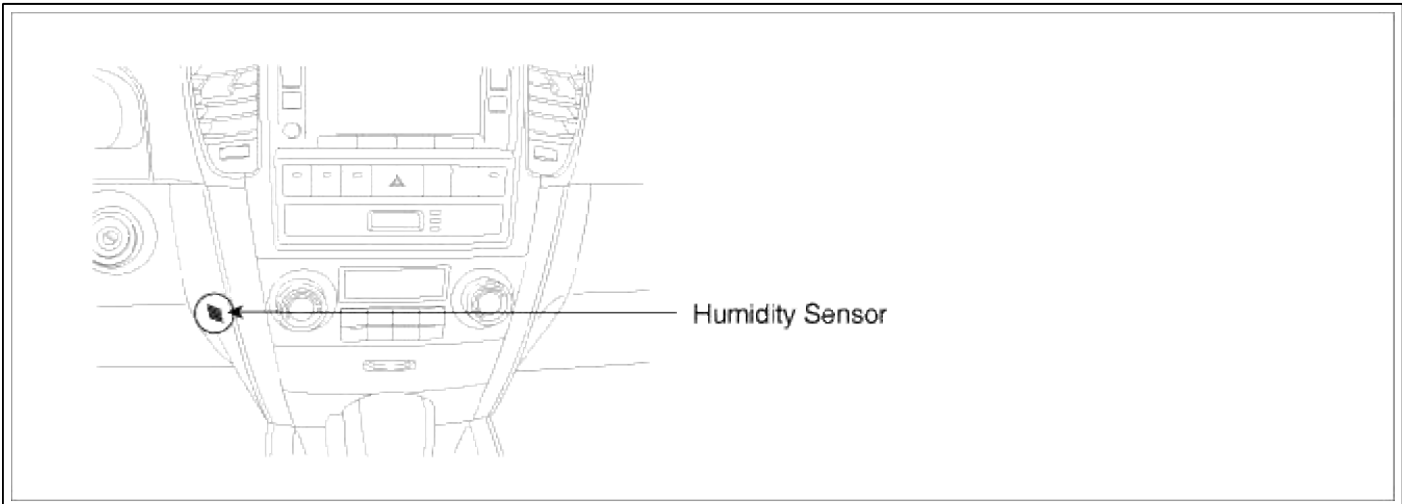
Go to the applicable troubleshooting procedure.

**NO**

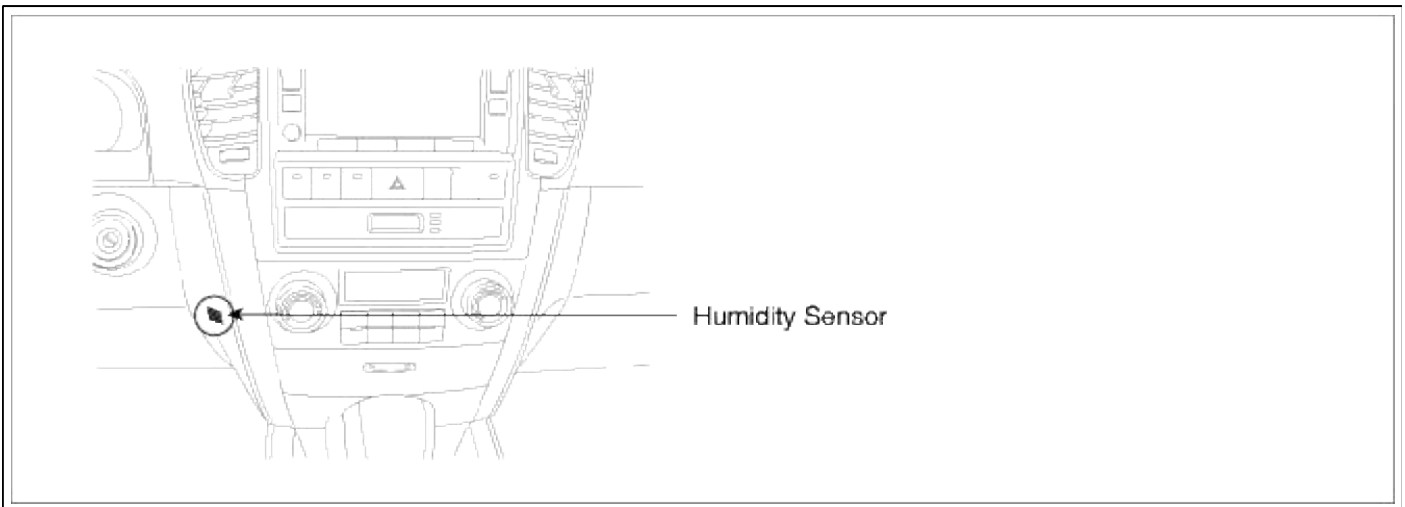
System is performing to specification at this time.

### Heating, Ventilation, Air Conditioning > Troubleshooting > B1201

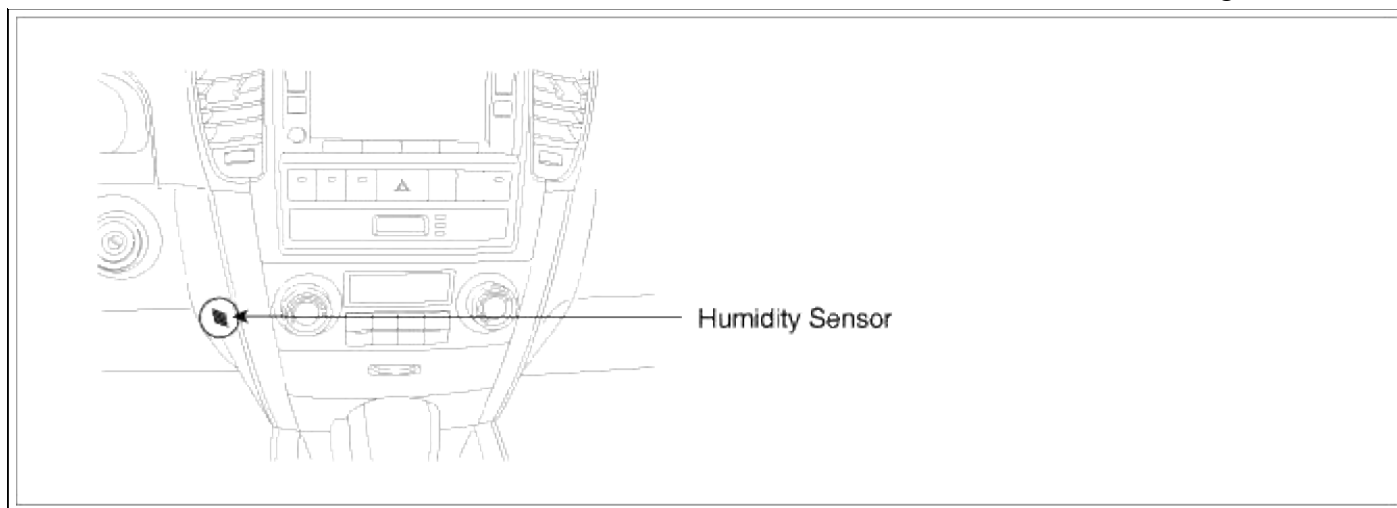
#### COMPONENT LOCATION



#### COMPONENT LOCATION



#### COMPONENT LOCATION



### GENERAL DESCRIPTION

Humidity sensor located at crush pad, detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity for preventing in-car fogging. Air conditioner operation depends on ambient temperature and humidity.

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Humidity sensor located at crush pad, detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity for preventing in-car fogging. Air conditioner operation depends on ambient temperature and humidity.

### DTC DESCRIPTION

The A/C controller sets DTC B1201 if there is a short circuit in humidity sensor signal harness or the measured frequency value of sensor is less than threshold value(about 6,186Hz)

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### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Frequency check	<ul style="list-style-type: none"> <li>• Open Circuit in power harness</li> <li>• Short Circuit in signal harness</li> <li>• Faulty Humidity Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• < 6,186 Hz	
Detecting time	• 10msec	
FAIL SAFE	• Control with the value of 10%	

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Threshold value	• < 6,186 Hz	
Detecting time	• 10msec	
FAIL SAFE	• Control with the value of 10%	

#### MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool while drying the humidity sensor with a hair drier or heat gun adjusted to a low heat setting.

1.2 CURRENT DATA	
HUMIDITY SENSOR	10 %
HEATER WATER TEMP. SNSR	12.0 °C
IN-CAR TEMP. SENSOR	11.0 °C
AMBIENT AIR TEMP. SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	89.79 %
<div> <div>FIX</div> <div>SCPN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
B1201 HUMIDITY SENSOR - SHORT(LOW)	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div>HELP</div> </div>	

**Fig. 2**

Fig 2 : DTC B1201.

## 4. Are the DTC B1201 present and is parameter of "Humidity Sensor" fixed?

Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool while drying the humidity sensor with a hair drier or heat gun adjusted to a low heat setting.

1.2 CURRENT DATA	
<b>HUMIDITY SENSOR</b>	<b>10 %</b>
HEATER WATER TEMP. SNSR	12.0 °C
IN-CAR TEMP. SENSOR	11.0 °C
AMBIENT AIR TEMP. SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENITIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	89.79 %

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1201 HUMIDITY SENSOR - SHORT(LOW)</b>	
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
HELP	

**Fig. 2**

Fig 2 : DTC B1201.

## 4. Are the DTC B1201 present and is parameter of "Humidity Sensor" fixed?

Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"

- Monitor the "Humidity Sensor" Parameter on the Scantool while drying the humidity sensor with a hair drier or heat gun adjusted to a low heat setting.

1.2 CURRENT DATA	
<b>HUMIDITY SENSOR</b>	<b>10 %</b>
HEATER WATER TEMP. SNSR	12.0 °C
IN-CAR TEMP. SENSOR	11.0 °C
AMBIENT AIR TEMP. SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENATIO. (DR.)	91.75 %
DIRECTION POTENTIAL DR.	89.79 %

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1201 HUMIDITY SENSOR - SHORT(LOW)</b>	
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
HELP	

Fig. 2

Fig 2 : DTC B1201.

- Are the DTC B1201 present and is parameter of "Humidity Sensor" fixed?

Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

- Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

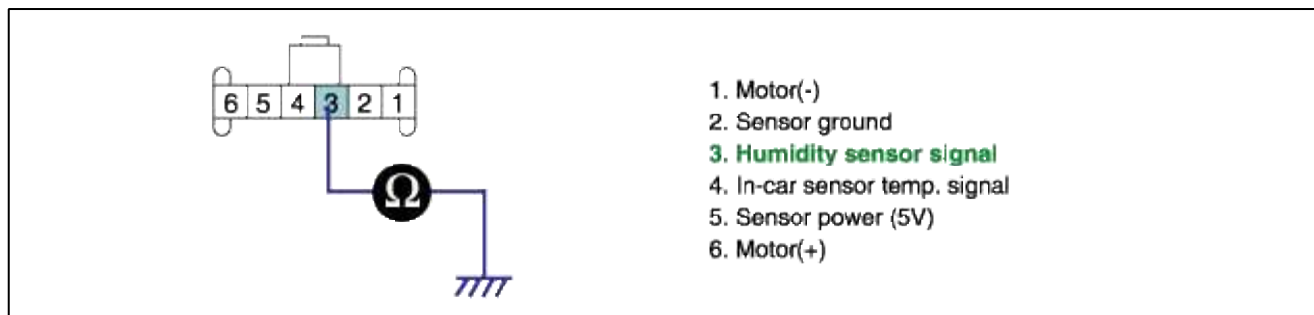
## SIGNAL CIRCUIT INSPECTION

## 1. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect Humidity Sensor.

(3) Measure resistance between terminal "3" of Humidity Sensor and chassis ground.

Specification : Approx.  $\infty \Omega$ 

(4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection " procedure.

**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

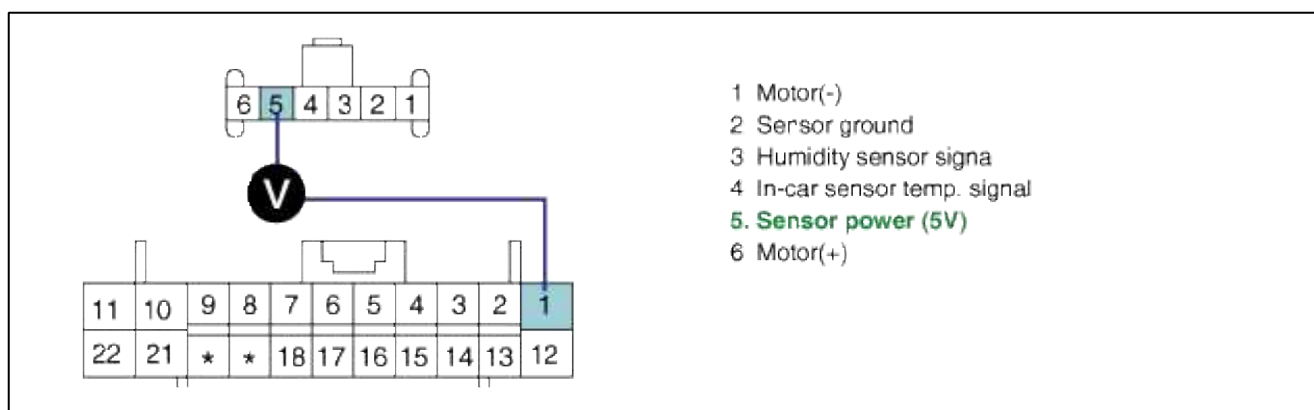
## POWER SUPPLY CIRCUIT INSPECTION

## 1. Check for open in power harness.

(1) Ignition "ON"

(2) Disconnect Humidity Sensor.

(3) Measure resistance value between terminal "5" of Humidity Sensor and terminal "1" of A/C control unit.

Specification :  $0\Omega$ 

(4) Is the measured voltage within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.



2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

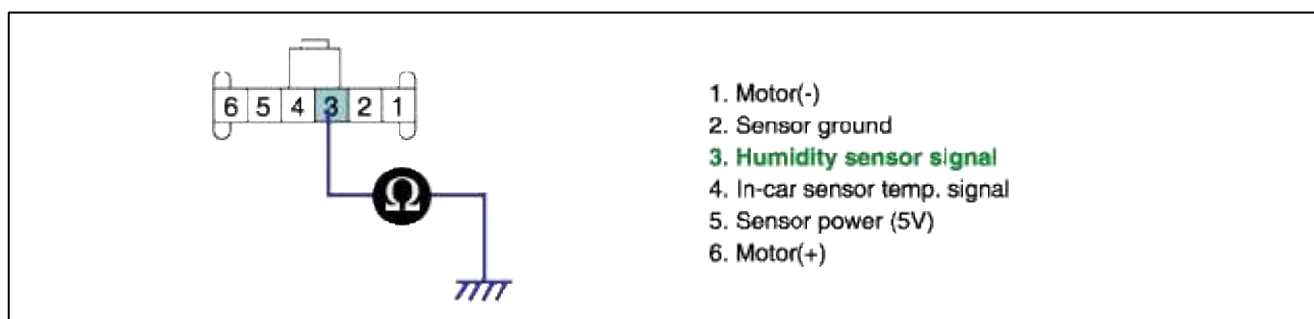
1. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect Humidity Sensor.

(3) Measure resistance between terminal "3" of Humidity Sensor and chassis ground.

Specification : Approx.  $\infty \Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

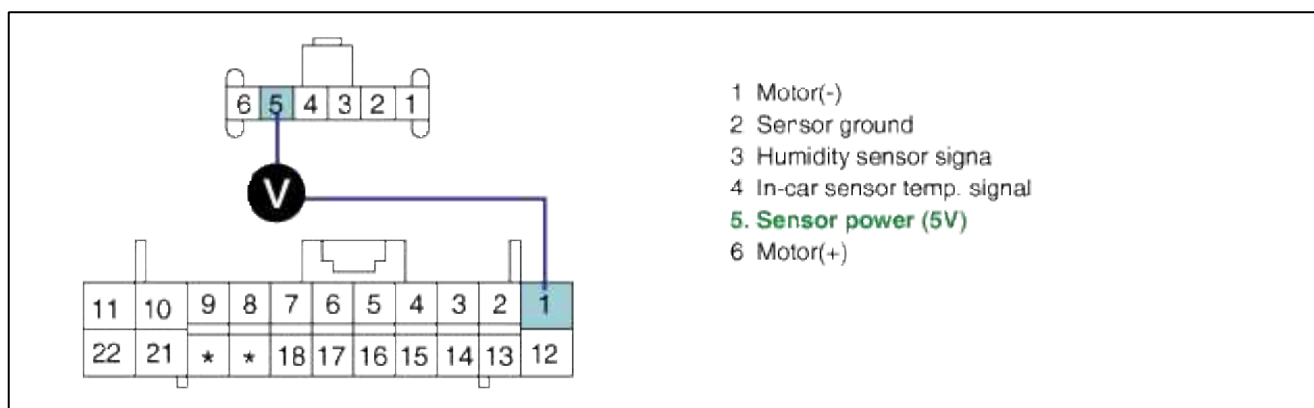
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(1) Ignition "ON"

(2) Disconnect Humidity Sensor.

(3) Measure resistance value between terminal "5" of Humidity Sensor and terminal "1" of A/C control unit.

Specification :  $0\Omega$



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Go to "Component Inspection " procedure.

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**YES**

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**NO**

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## SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.

(1) Ignition "OFF"

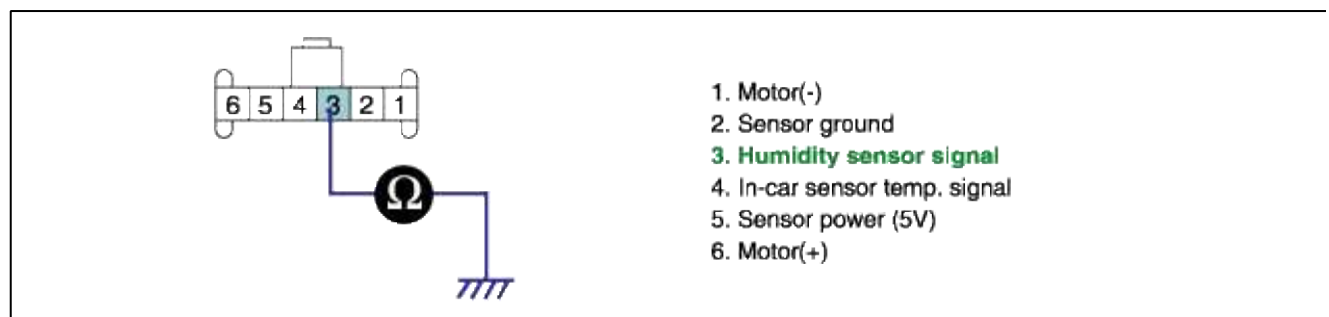
(2) Disconnect Humidity Sensor.

(3) Measure resistance between terminal "3" of Humidity Sensor and chassis ground.

---

Specification : Approx.  $\infty \Omega$

---



(4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection " procedure.

**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

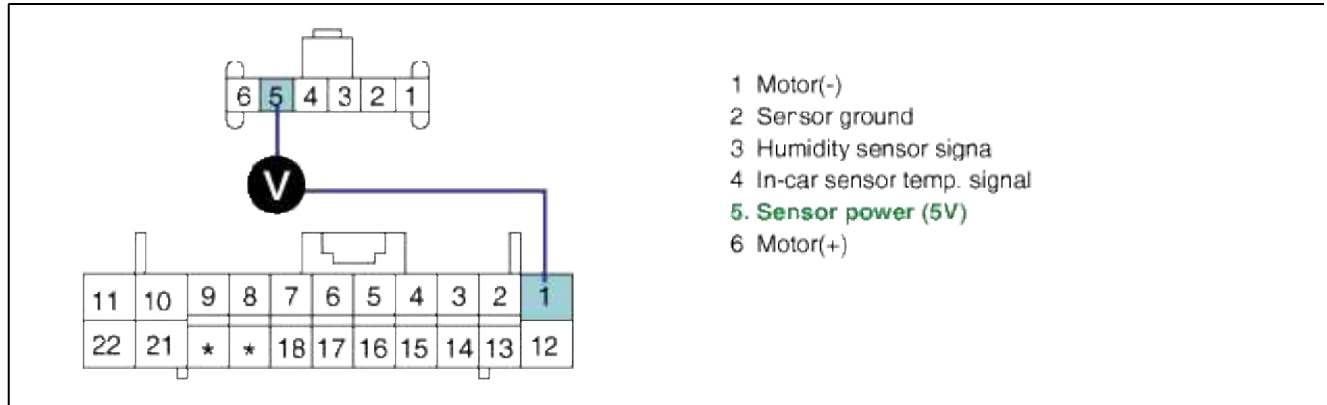
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(3) Measure resistance value between terminal "5" of Humidity Sensor and terminal "1" of A/C control unit.

Specification :  $0\Omega$ 

(4) Is the measured voltage within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

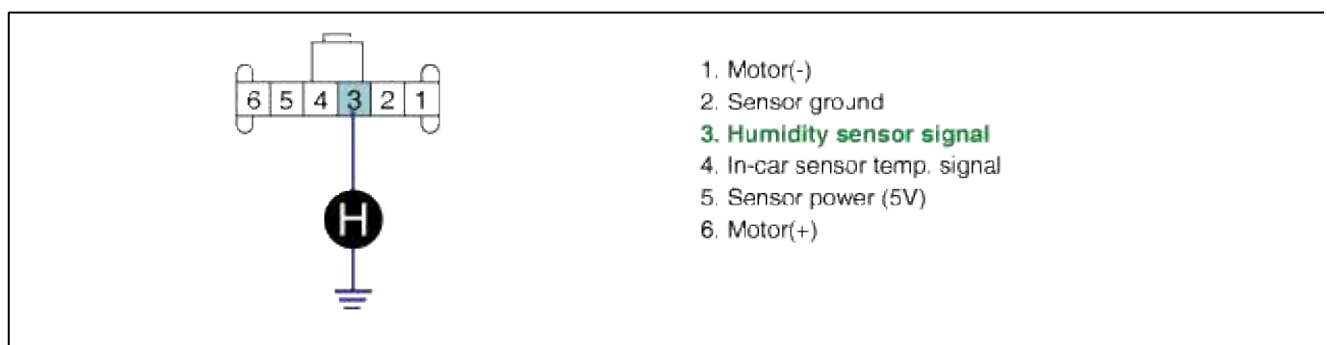
## 1. Check Humidity Sensor.

(1) Engine "ON"

(2) Connect Humidity Sensor.

(3) Measure Frequency between terminal "3" of Humidity sensor and chassis ground.

Specification : Refer the specifications in fig 5.



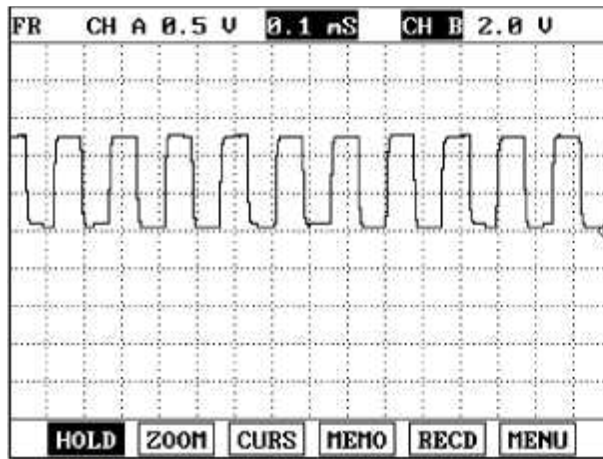


Fig. 3

Fig 3 : Signal waveform of Humidity sensor.

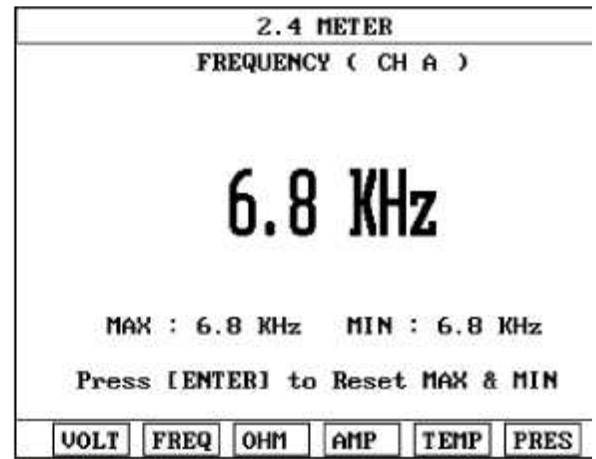


Fig. 4

Fig 4 : Frequency of Humidity sensor Measured by scantool.

- (4) Is the measured frequency within specifications in fig 5? (tolerance limits  $\pm 5\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

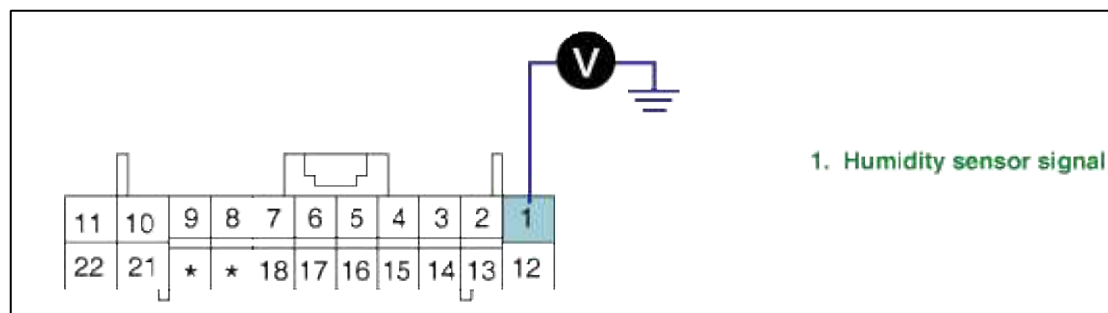
Substitute with a known-good Humidity sensor and check for proper operation.

If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect Humidity Sensor.
- (3) Measure voltage value between terminal "1" of A/C control unit and chassis ground.

Specification : 5V



- (4) Is the measured voltage within specification?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

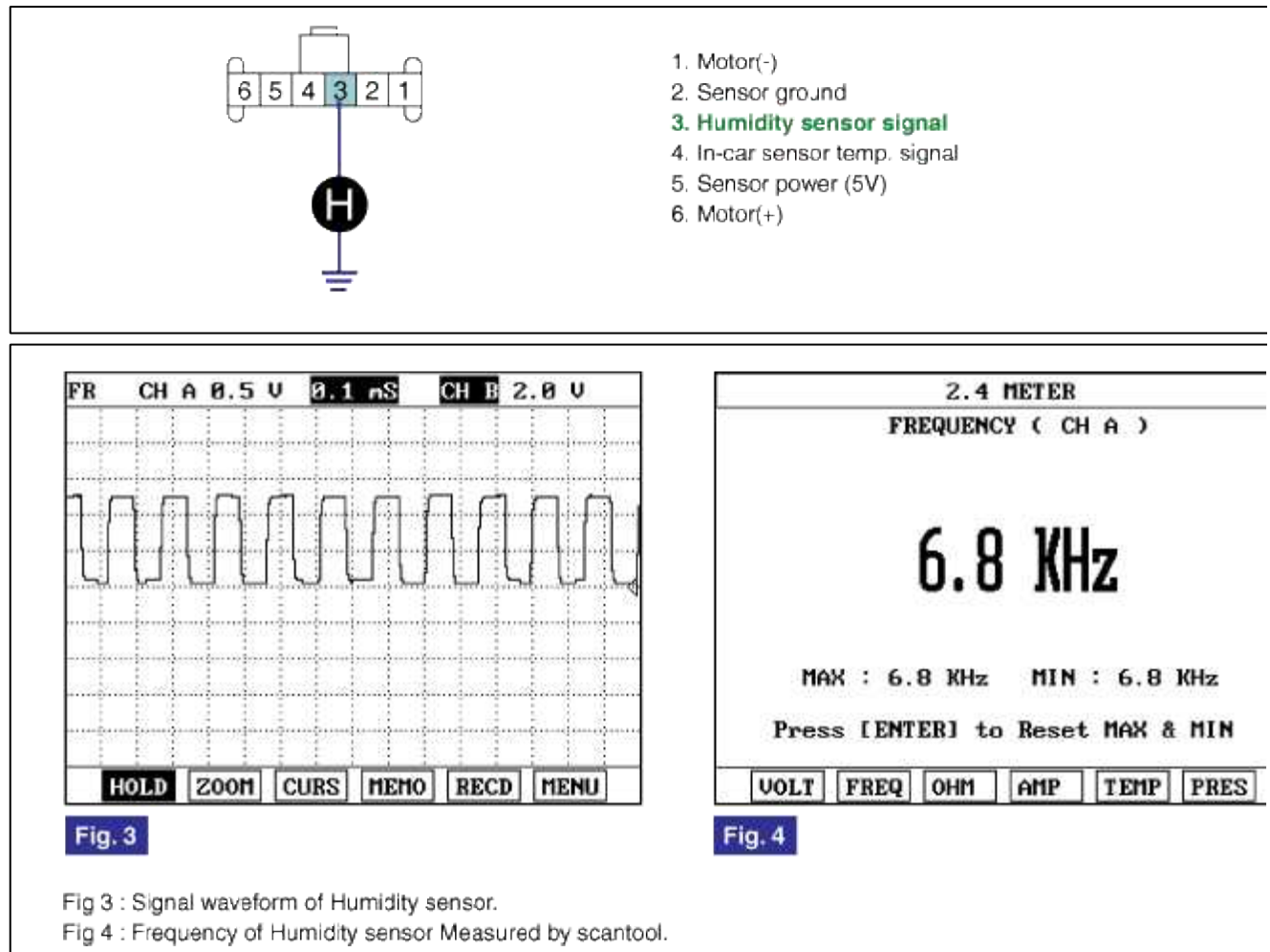
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure

## COMPONENT INSPECTION

## 1. Check Humidity Sensor.

- (1) Engine "ON"
- (2) Connect Humidity Sensor.
- (3) Measure Frequency between terminal "3" of Humidity sensor and chassis ground.

Specification : Refer the specifications in fig 5.



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**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

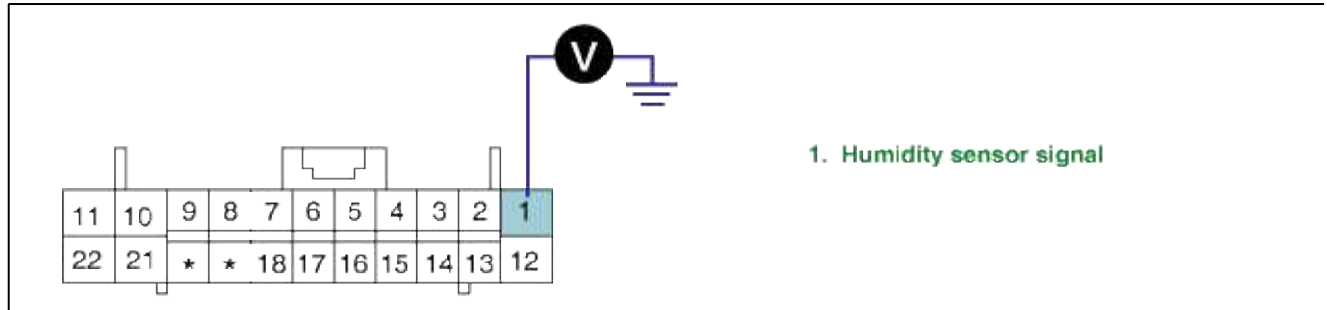
Substitute with a known-good Humidity sensor and check for proper operation.

If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect Humidity Sensor.
- (3) Measure voltage value between terminal "1" of A/C control unit and chassis ground.

Specification : 5V



- (4) Is the measured voltage within specification?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

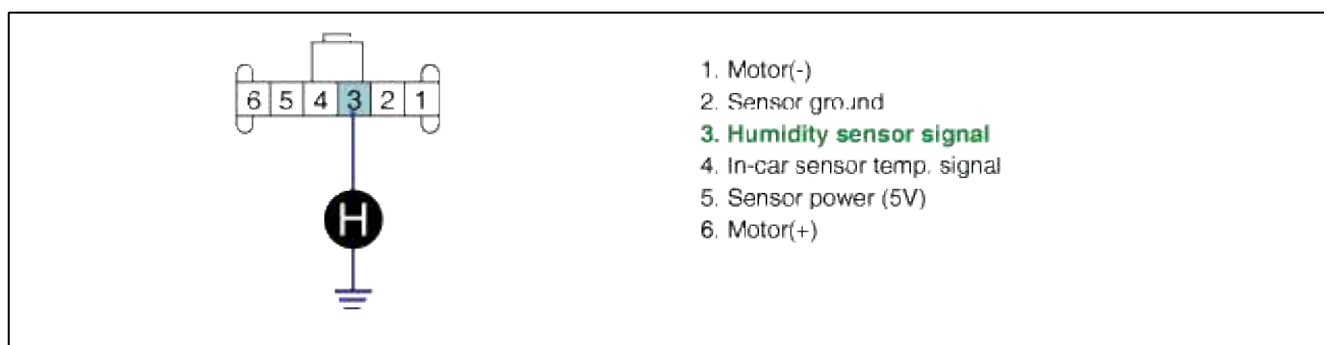
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

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- (1) Engine "ON"
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Specification : Refer the specifications in fig 5.



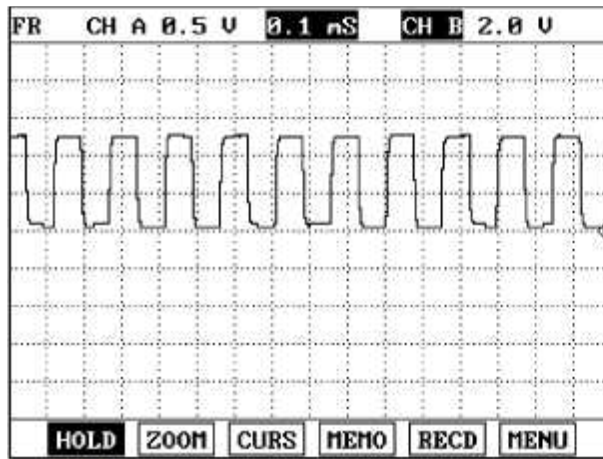


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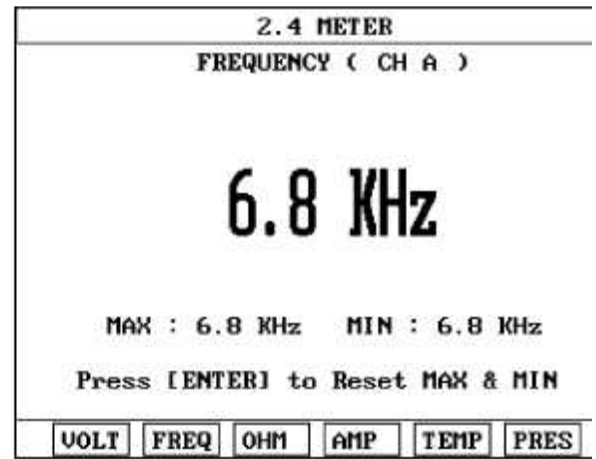


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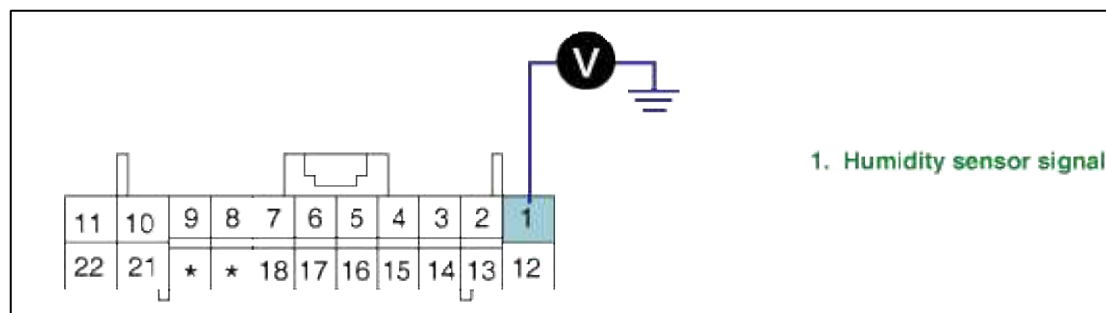
Substitute with a known-good Humidity sensor and check for proper operation.

If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect Humidity Sensor.
- (3) Measure voltage value between terminal "1" of A/C control unit and chassis ground.

Specification : 5V



- (4) Is the measured voltage within specification?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.

2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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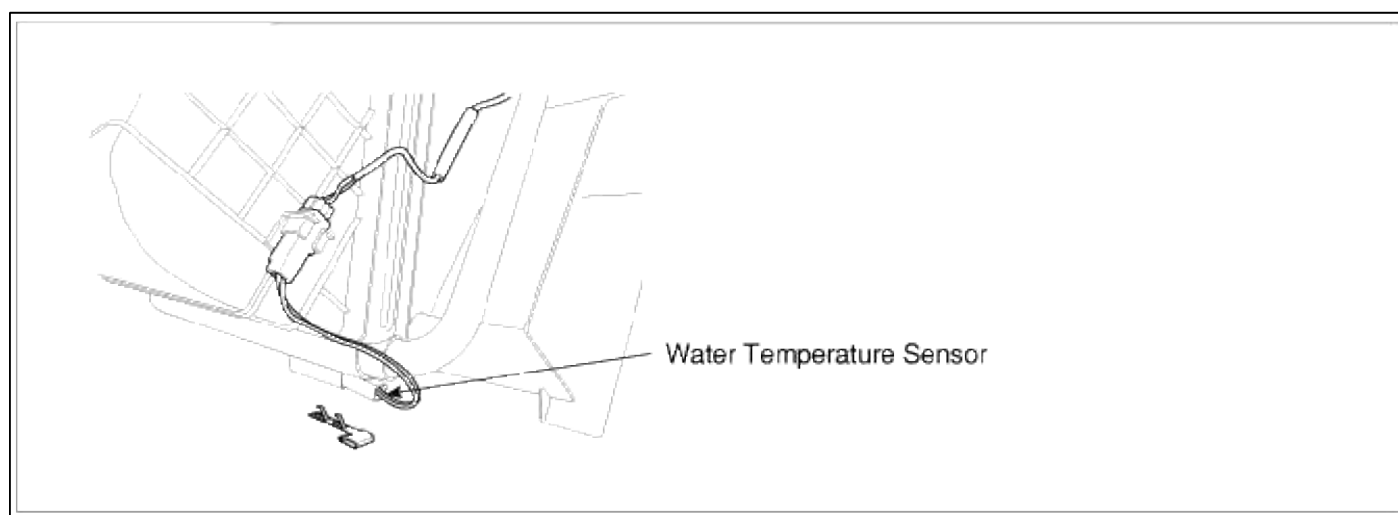
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**NO**

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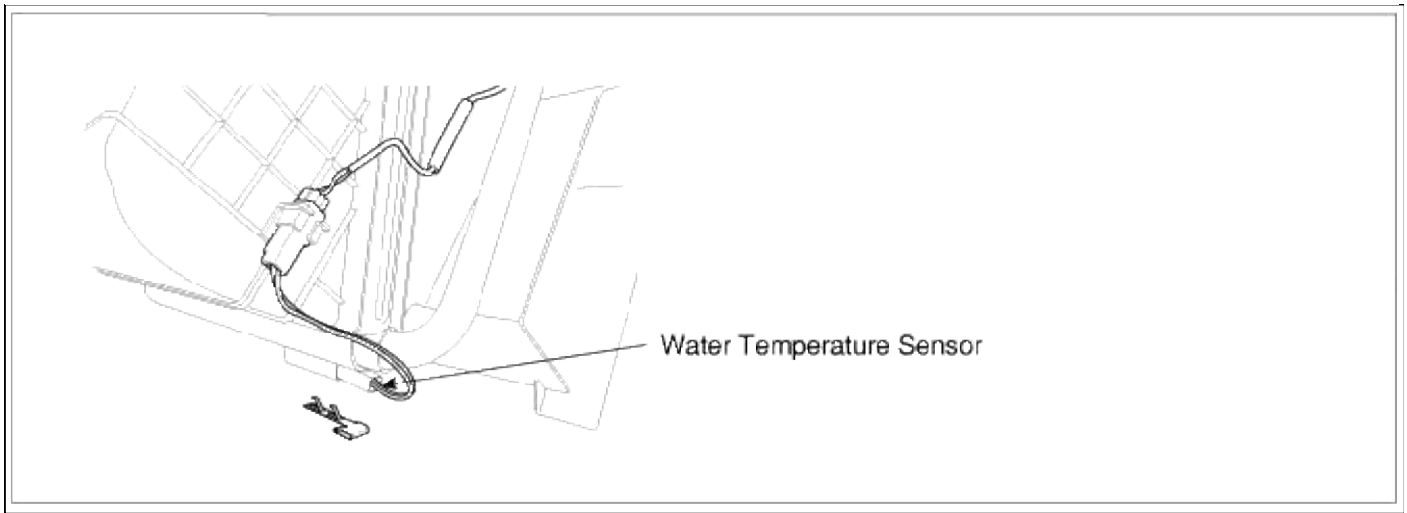
### Heating,Ventilation, Air Conditioning > Troubleshooting > B1202

#### COMPONENT LOCATION

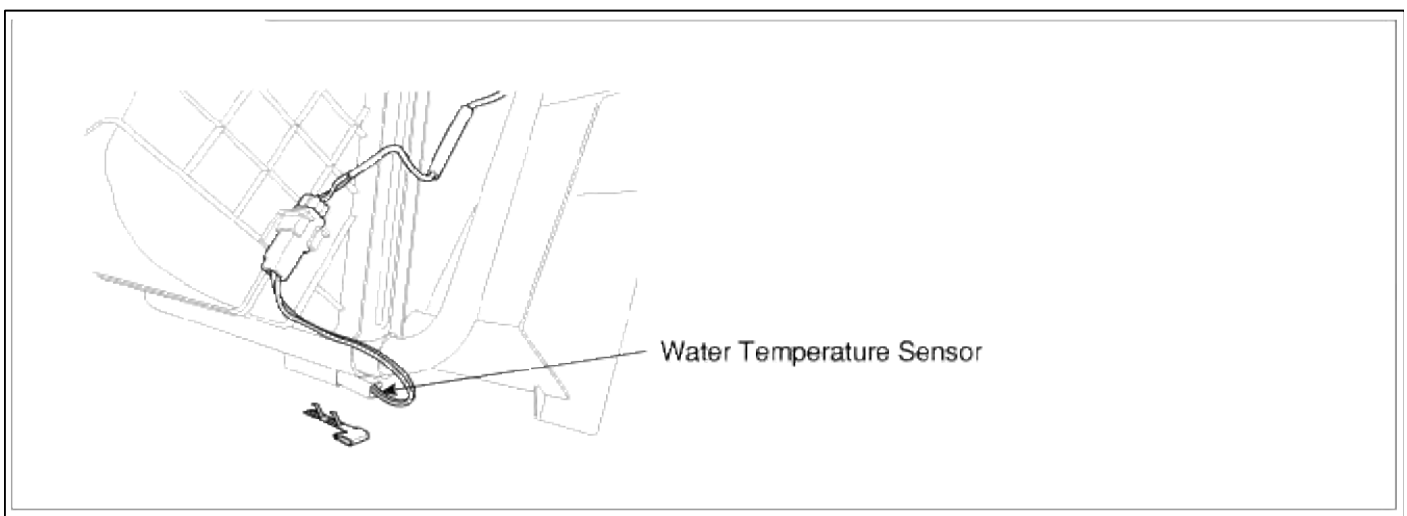


#### COMPONENT LOCATION





## COMPONENT LOCATION



## GENERAL DESCRIPTION

A water temp. sensor located at heater unit, detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

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## DTC DESCRIPTION

The A/C controller sets DTC B1202 if there is an open circuit in water temp. sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 176.3k $\Omega$ )

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## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Open Circuit in harness</li> <li>• Faulty water temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• > 176.3 k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

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## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"

## 3. Monitor the "WATER TEMP. SENSOR" Parameter on the Scantool.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	-2 °C
IN-CAR TEMP. SENSOR	12.0 °C
AMBIENT AIR TEMP. SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	54.89 %
PASSENGER PHOTO SENSOR	255
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1202.

1.1 DIAGNOSTIC TROUBLE CODES	
B1202 WATER TEMP. SENS - OPEN(HIGH)	
<div> <div>NUMBER OF DTC : 1 ITEMS</div> </div>	
<div> <div>PART</div> <div>ERAS</div> <div>HELP</div> </div>	

Fig. 2

## 4. Are the DTC B1202 present and is parameter of "WATER TEMP. SENSOR" fixed?

Parameter of "WATER TEMP. SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in WATER TEMP. SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

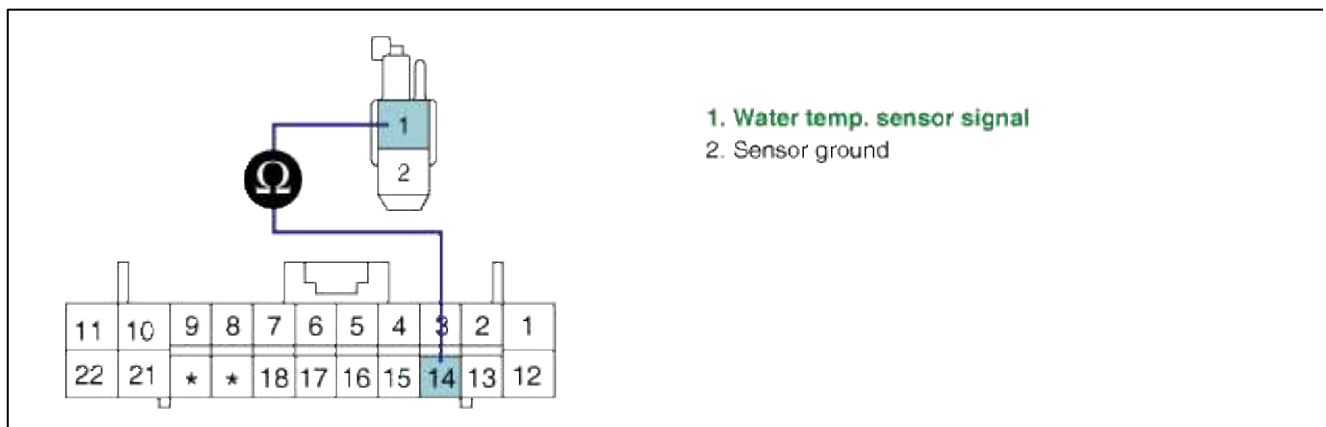
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect water temp. sensor.

(3) Measure resistance between terminal "1" of water temp. sensor and terminal "14" of A/C Control Unit.

Specification : Approx.  $0\ \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### GROUND CIRCUIT INSPECTION

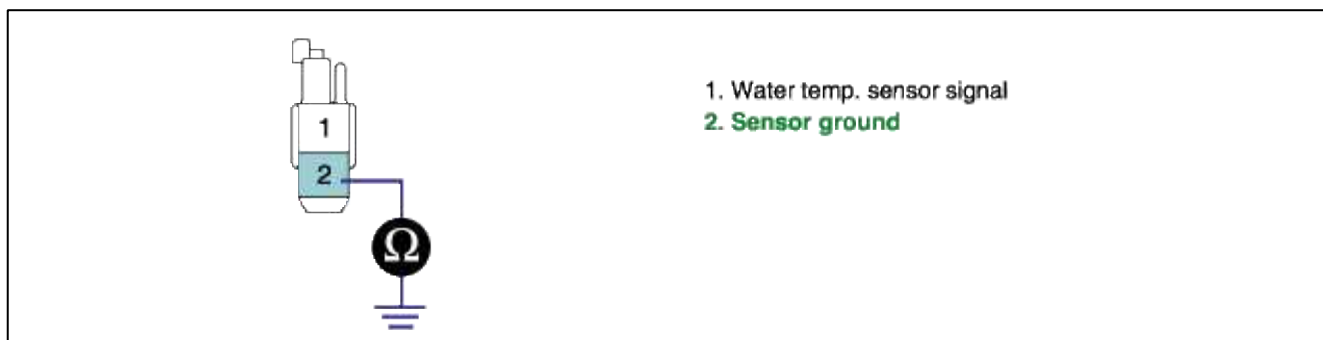
1. Check for open in ground harness.

(1) Ignition "OFF"

(2) Disconnect water temp. sensor.

(3) Measure resistance between terminal "2" of water temp. sensor and chassis ground.

Specification : Approx.  $0\ \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

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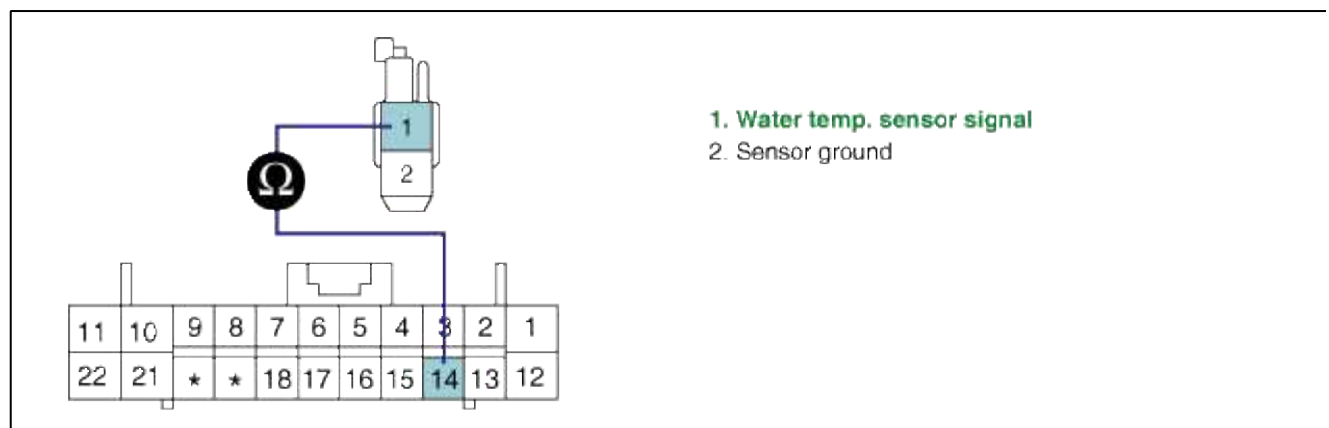
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect water temp. sensor.

(3) Measure resistance between terminal "1" of water temp. sensor and terminal "14" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

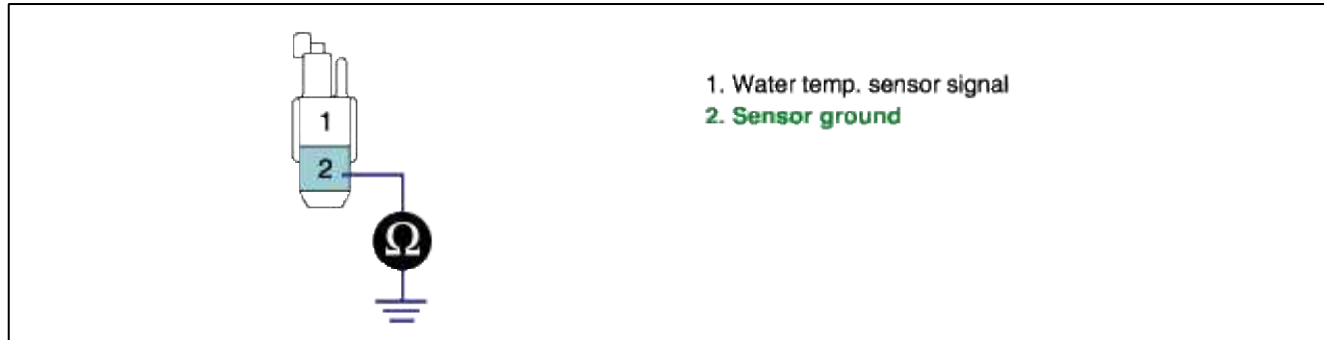
**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect water temp. sensor.
  - (3) Measure resistance between terminal "2" of water temp. sensor and chassis ground.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
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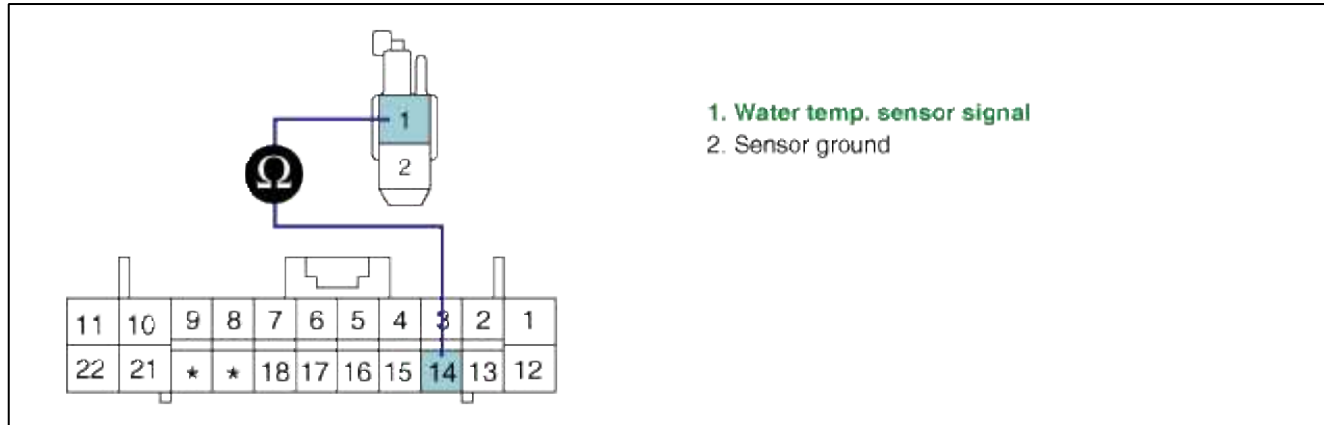
**NO**

Go to "Signal circuit inspection" procedure.

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1. Check for open in harness.
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  - (3) Measure resistance between terminal "1" of water temp. sensor and terminal "14" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

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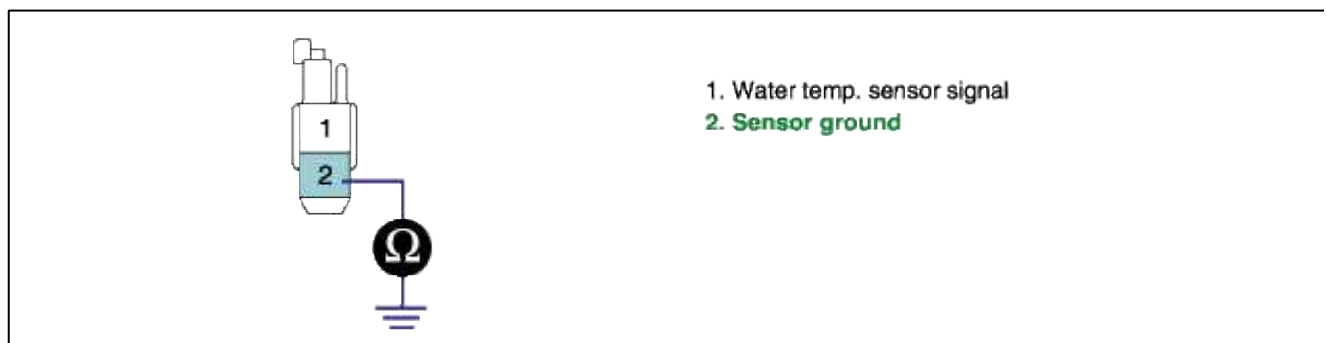
**NO**

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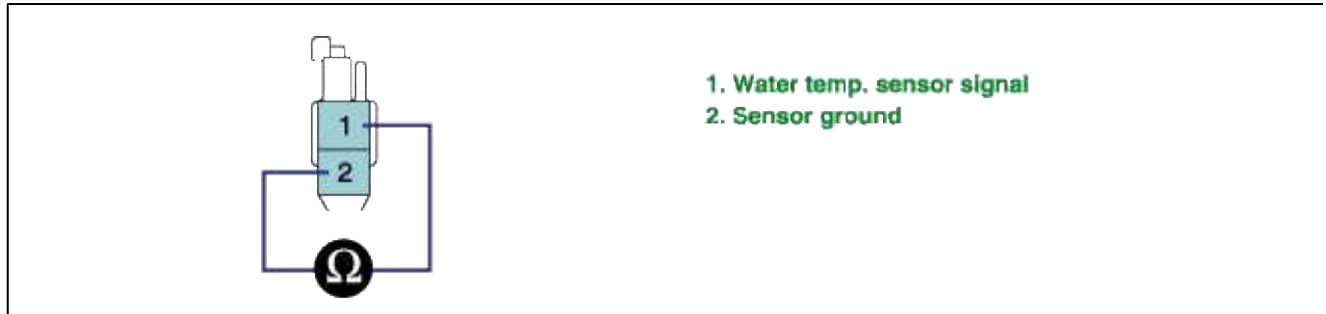
Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION



1. Check water temp. sensor.
  - (1) Ignition "OFF"
  - (2) Disconnect water temp. sensor.
  - (3) Measure resistance between terminal "1" and "2" of water temp. sensor.

Specification : Refer the specifications in fig 3.



- (4) Is the measured resistance within specifications in fig 3)? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

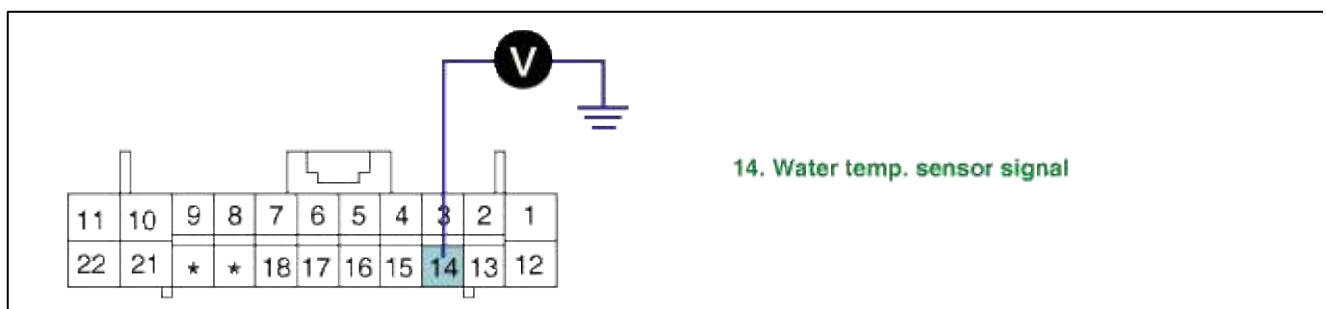
Substitute with a known-good water temp. sensor and check for proper operation.

If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect water temp. sensor.
- (3) Measure Voltage between terminal "14" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

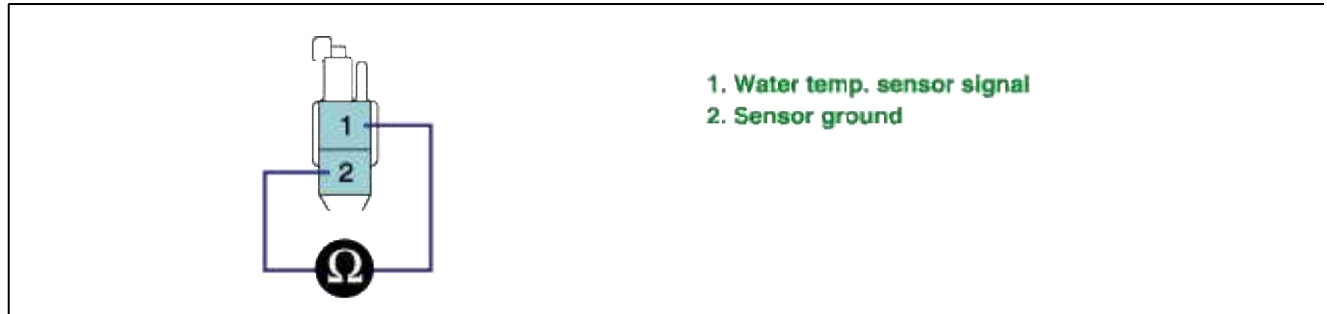
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Check water temp. sensor.
  - (1) Ignition "OFF"
  - (2) Disconnect water temp. sensor.
  - (3) Measure resistance between terminal "1" and "2" of water temp. sensor.

Specification : Refer the specifications in fig 3.



- (4) Is the measured resistance within specifications in fig 3)? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

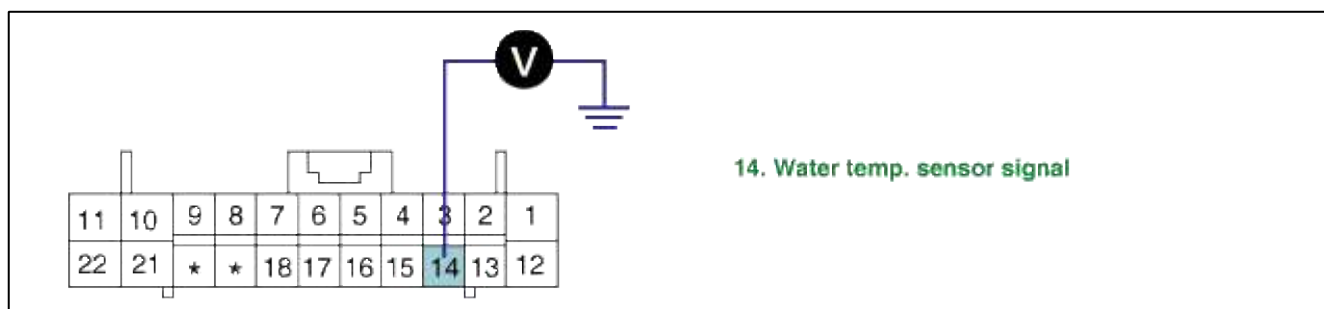
Substitute with a known-good water temp. sensor and check for proper operation.

If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

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- (1) Engine "ON"
- (2) Disconnect water temp. sensor.
- (3) Measure Voltage between terminal "14" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

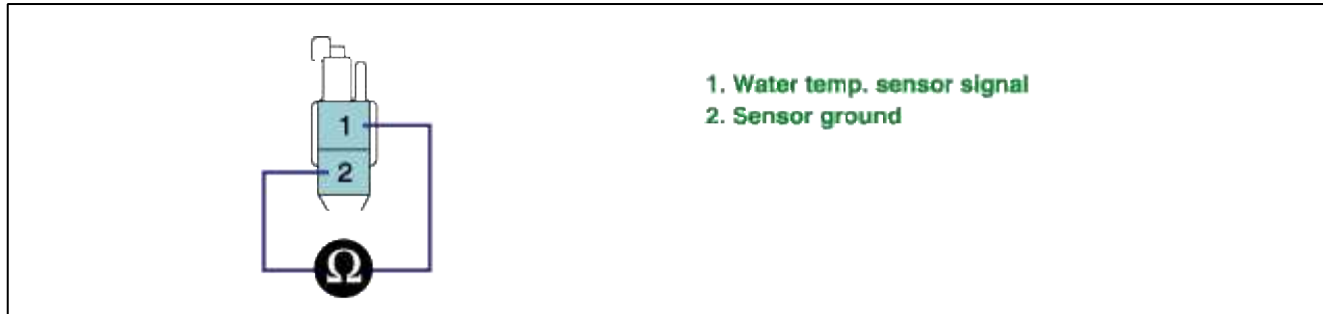
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Check water temp. sensor.
  - (1) Ignition "OFF"
  - (2) Disconnect water temp. sensor.
  - (3) Measure resistance between terminal "1" and "2" of water temp. sensor.

Specification : Refer the specifications in fig 3.



- (4) Is the measured resistance within specifications in fig 3)? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

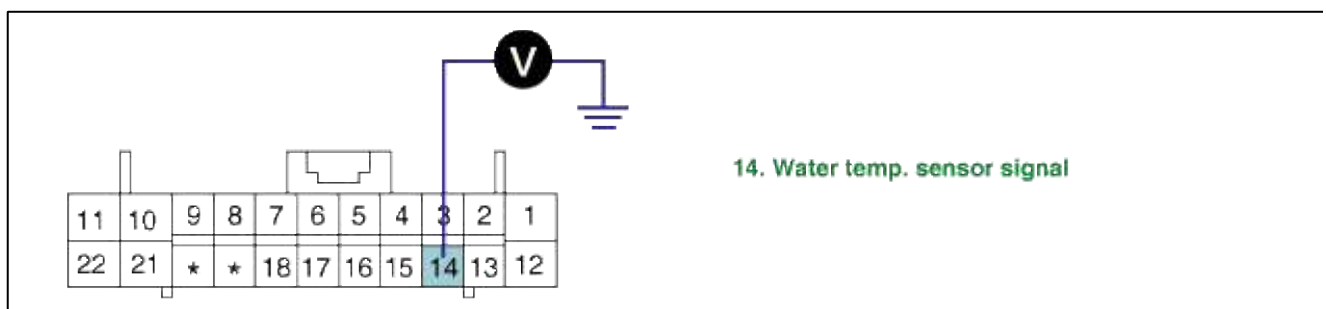
Substitute with a known-good water temp. sensor and check for proper operation.

If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect water temp. sensor.
- (3) Measure Voltage between terminal "14" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.

2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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**YES**

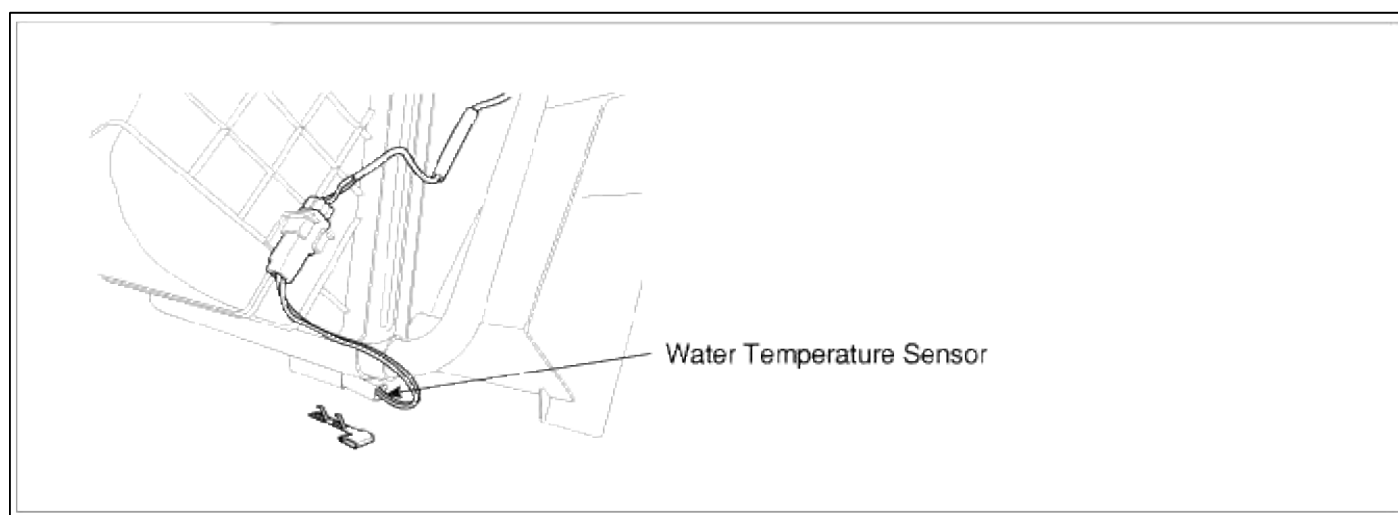
Go to the applicable troubleshooting procedure.

**NO**

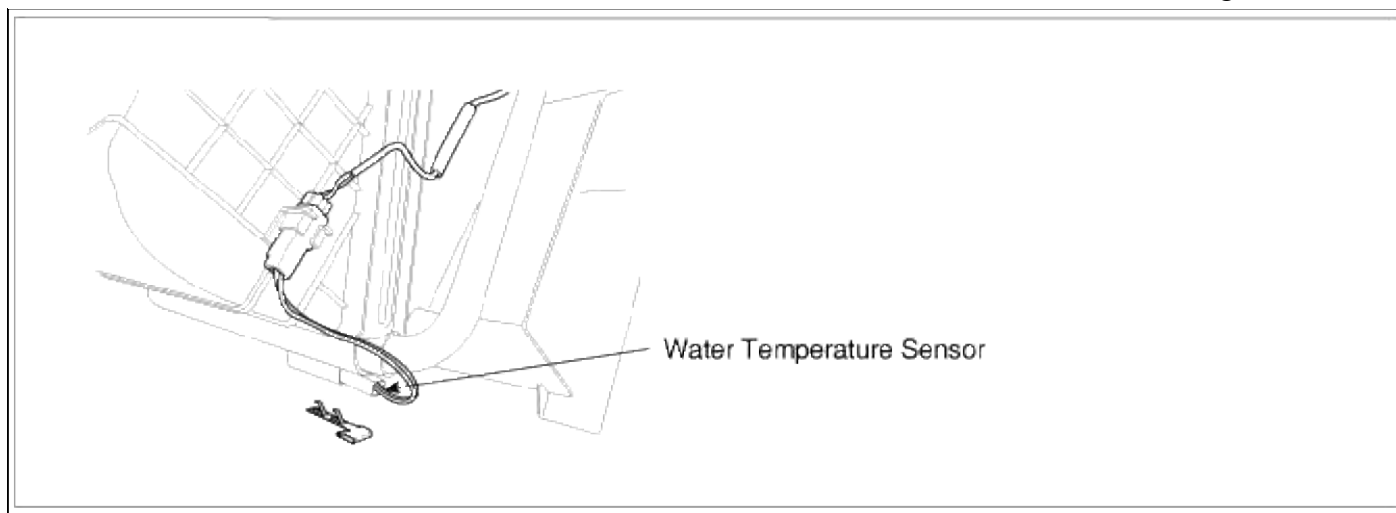
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1203

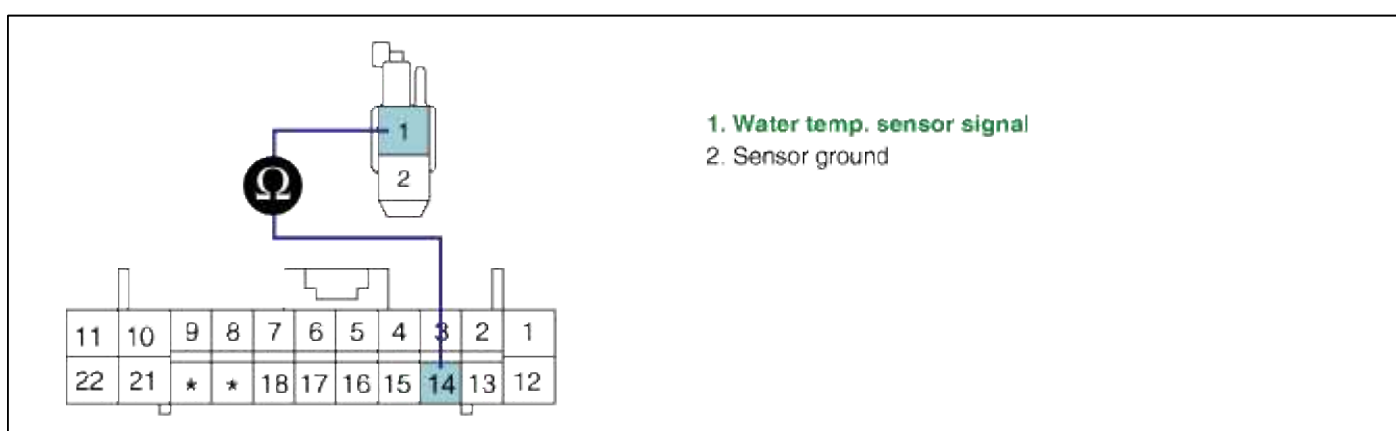
#### COMPONENT LOCATION



#### COMPONENT LOCATION



## COMPONENT LOCATION



## GENERAL DESCRIPTION

A water temp. sensor located at heater unit, detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

## GENERAL DESCRIPTION

A water temp. sensor located at heater unit, detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

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A water temp. sensor located at heater unit, detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

## DTC DESCRIPTION

The A/C controller sets DTC B1203 if there is a short circuit in water temp. sensor signal harness or the measured resistance value of sensor is less than threshold value(about 1.2kΩ)

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty water temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• < 1.2 k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

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Detecting time	• 0.3 sec	
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DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty water temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• < 1.2 k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

#### MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"

## 3. Monitor the "WATER TEMP. SENSOR" Parameter on the Scantool.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	-2 °C
IN-CAR TEMP. SENSOR	12.0 °C
AMBIENT AIR TEMP. SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POSENTIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	54.89 %
PASSENGER PHOTO SENSOR	255
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
B1203 WATER TEMP. SENS - SHORT(LOW)	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B1203.

## 4. Are the DTC B1203 present and is parameter of "WATER TEMP. SENSOR" fixed?

Parameter of "WATER TEMP. SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in WATER TEMP. SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.



3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.

(1) Ignition "OFF"

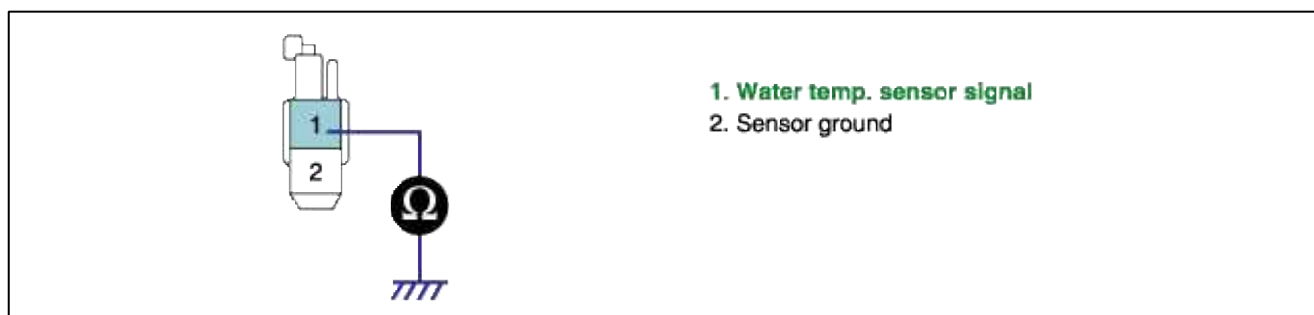
(2) Disconnect water temp. sensor.

(3) Measure resistance between terminal "1" of water temp. sensor and chassis ground.

---

Specification : Approx.  $\infty\Omega$

---



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

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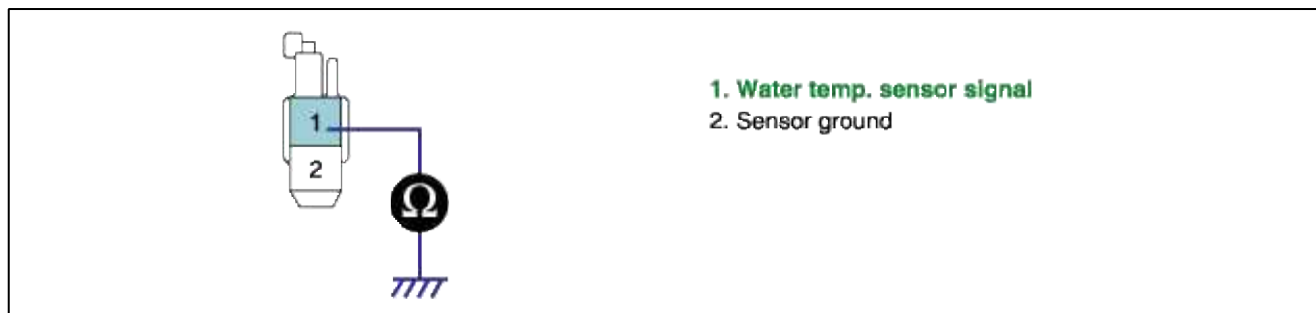
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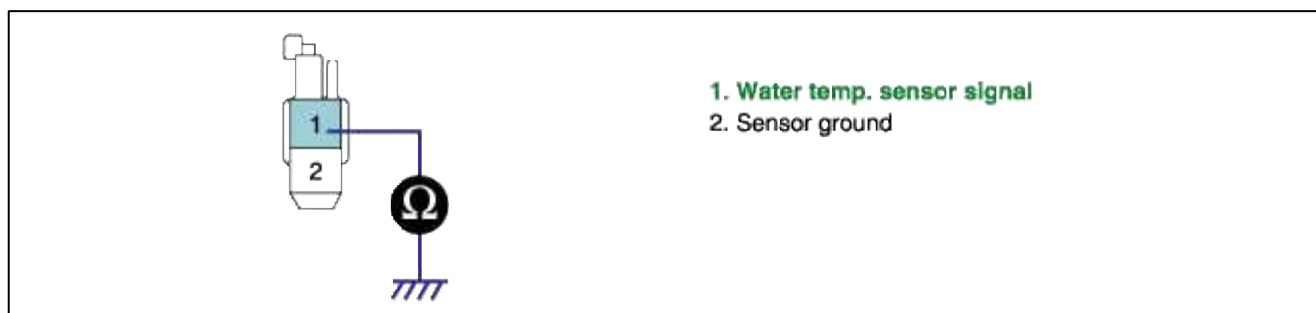
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---

Specification : Approx.  $\infty\Omega$

---



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

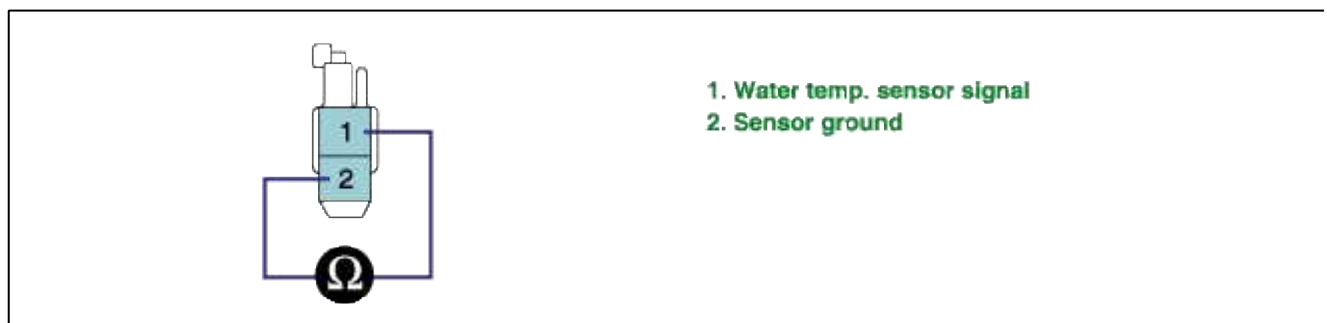
1. Check water temp. sensor.

(1) Ignition "OFF"

(2) Disconnect water temp. sensor.

(3) Measure resistance between terminal "1" and "2" of water temp. sensor.

Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig 3)? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good water temp. sensor and check for proper operation.

If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

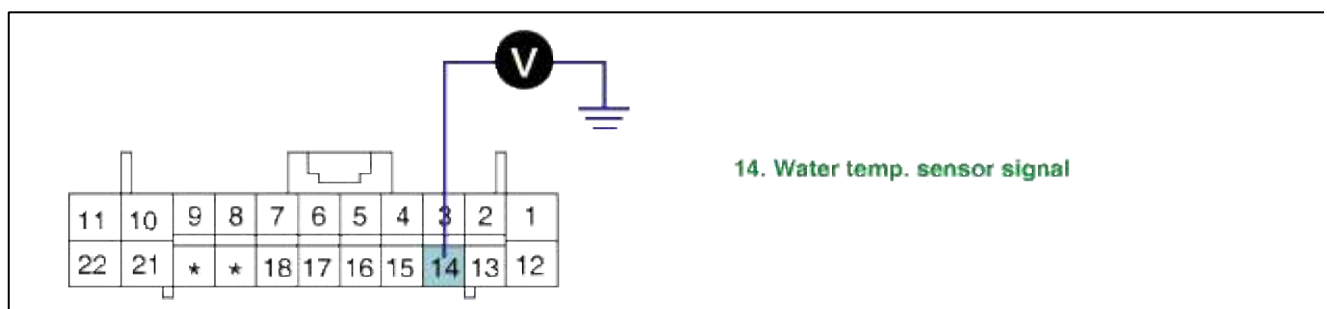
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect water temp. sensor.

(3) Measure Voltage between terminal "14" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

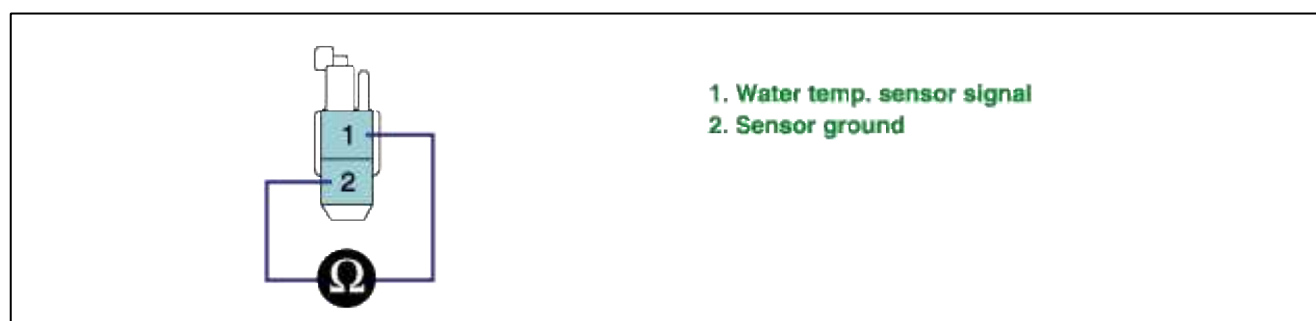
1. Check water temp. sensor.

(1) Ignition "OFF"

(2) Disconnect water temp. sensor.

(3) Measure resistance between terminal "1" and "2" of water temp. sensor.

Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig 3)? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good water temp. sensor and check for proper operation.

If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

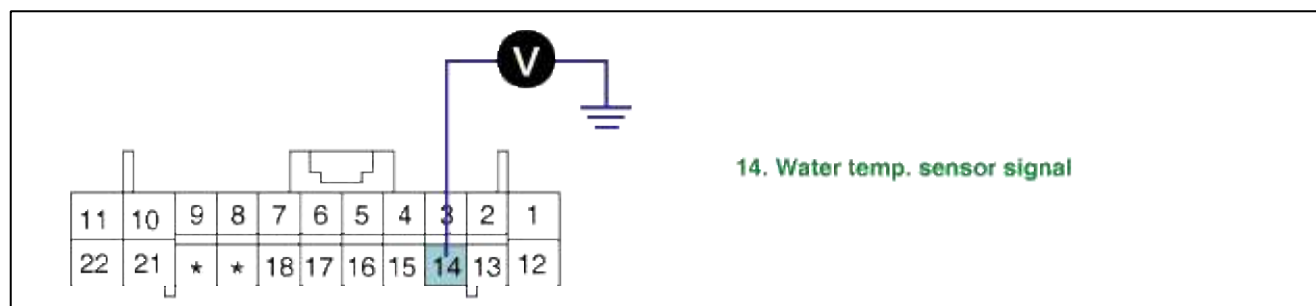
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect water temp. sensor.

(3) Measure Voltage between terminal "14" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

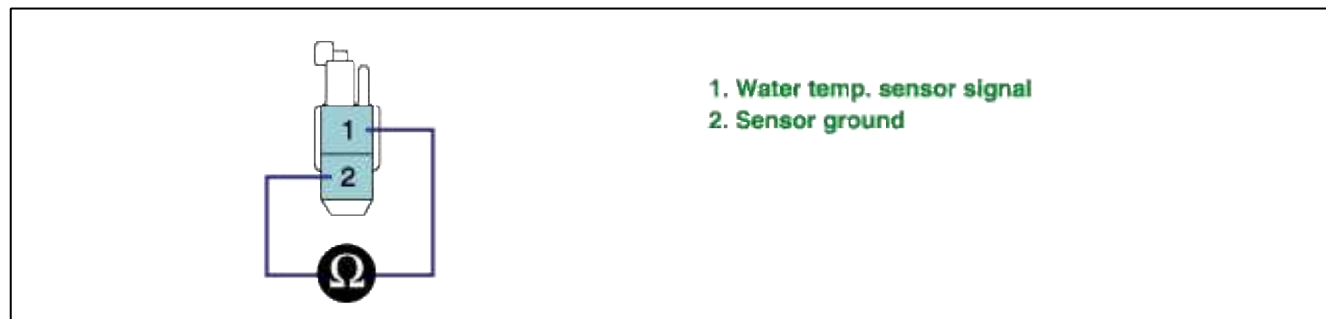
1. Check water temp. sensor.

(1) Ignition "OFF"

(2) Disconnect water temp. sensor.

(3) Measure resistance between terminal "1" and "2" of water temp. sensor.

Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig 3)? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good water temp. sensor and check for proper operation.

If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

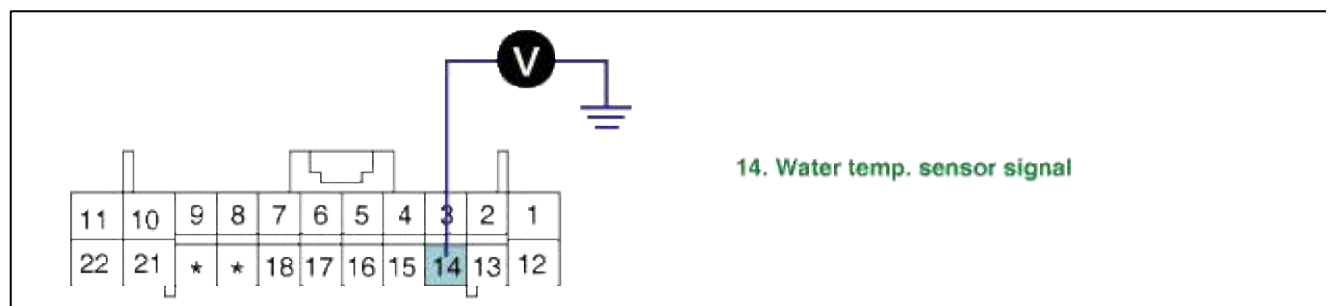
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect water temp. sensor.

(3) Measure Voltage between terminal "14" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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**YES**

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**NO**

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1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
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3. Are any DTCs present?

**YES**

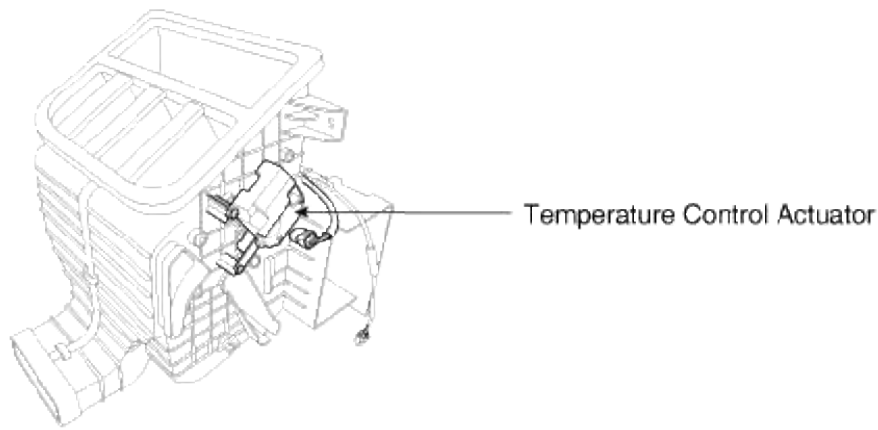
Go to the applicable troubleshooting procedure.

**NO**

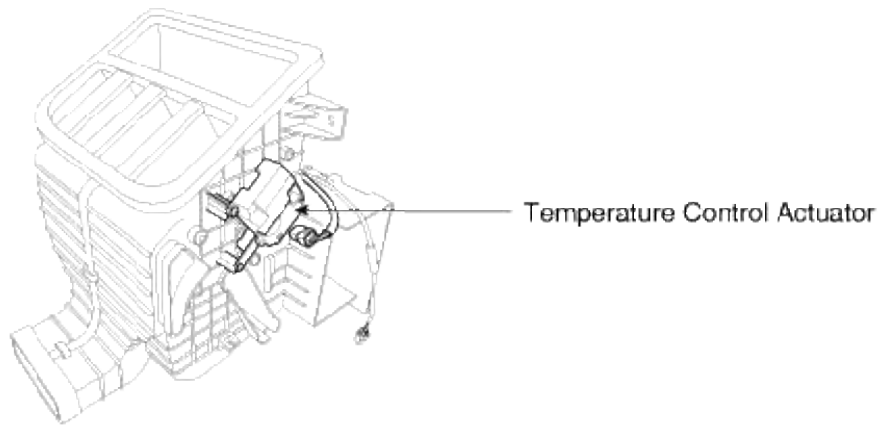
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1204

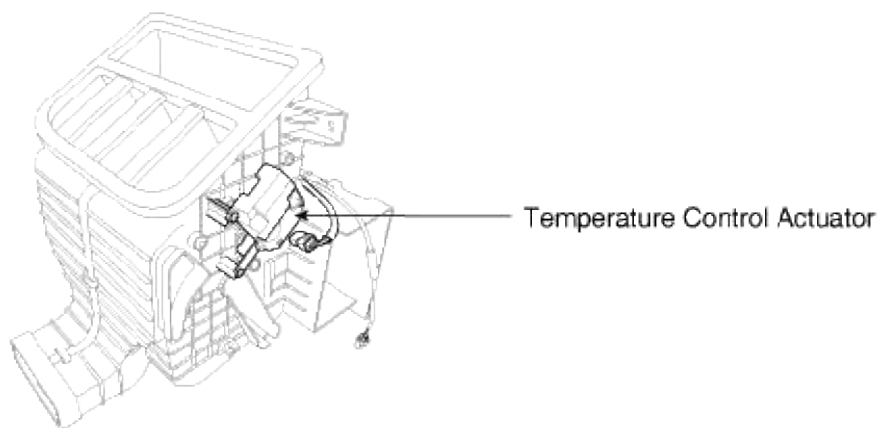
#### COMPONENT LOCATION



## COMPONENT LOCATION



## COMPONENT LOCATION



## GENERAL DESCRIPTION

Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

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#### DTC DESCRIPTION

The A/C controller sets DTC B1204 if there is an open circuit or poor connection in the air mix potentiometer.

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• If temperature setting 17~24.5°C(63~76°F) fix at max. cooling position.</li> <li>• If temperature setting 25~32°C(77~90°F) fix at max. heating position.</li> </ul>	

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## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Passenger's Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	13.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	12.5 °C	■
DRIVER PHOTO SENSOR	0.00 V	
AIR MIX POPENTIO.(PA.)	5.9 %	
DIRECTION POTENIO.DR.	90.18 %	
PASSENGER PHOTO SENSOR	255	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES		
B1204 AIR MIX P. - LOW INPUT		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>		

Fig. 2

Fig 2 : DTC B1204.

4. Are the DTC B1204 present and is parameter of "Passenger's Air Mix Potentiometer" fixed?

Parameter of "Passenger's Air Mix Potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Passenger's Air Mix potentiometer.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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DIRECTION POTENIO.DR.	90.18 %	
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FIX	SCRN	FULL PART GRPH HELP

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<b>B1204 AIR MIX P. - LOW INPUT</b>		
NUMBER OF DTC : 1 ITEMS		
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## TERMINAL AND CONNECTOR INSPECTION

### 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

### 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

### 3. Has a problem been found?

**YES** 

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO** 

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

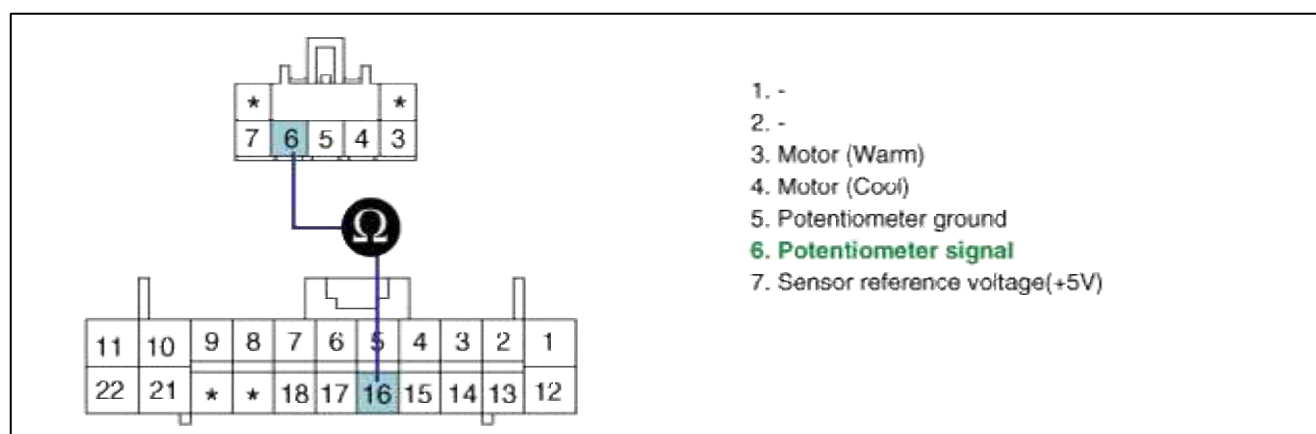
### 1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Passenger's Air Mix potentiometer.

(3) Measure resistance between terminal "6" of Passenger's Air Mix Potentiometer and terminal "16" of A/C contr

Specification : Approx. 0  $\Omega$



### (4) Is the measured resistance within specifications?

**YES** 

Go to "Check for short to ground in harness" procedure.

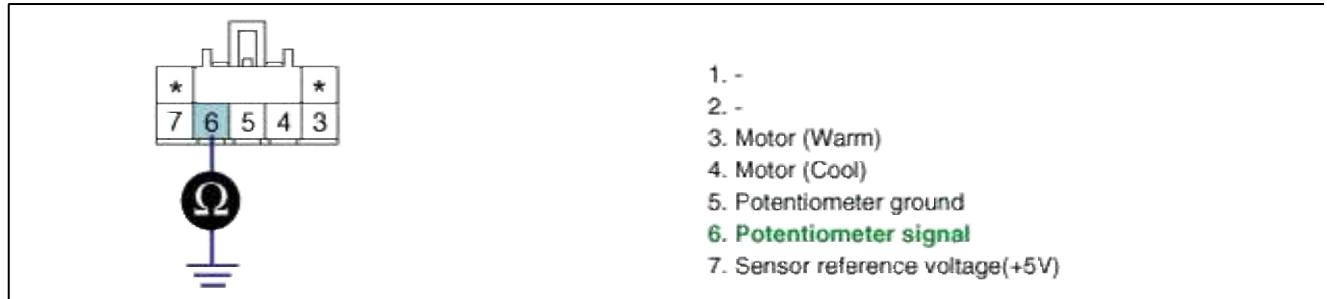
**NO** 

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Passenger's Air Mix potentiometer.
- (3) Measure resistance between terminal "6" of Passenger's Air Mix Potentiometer and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

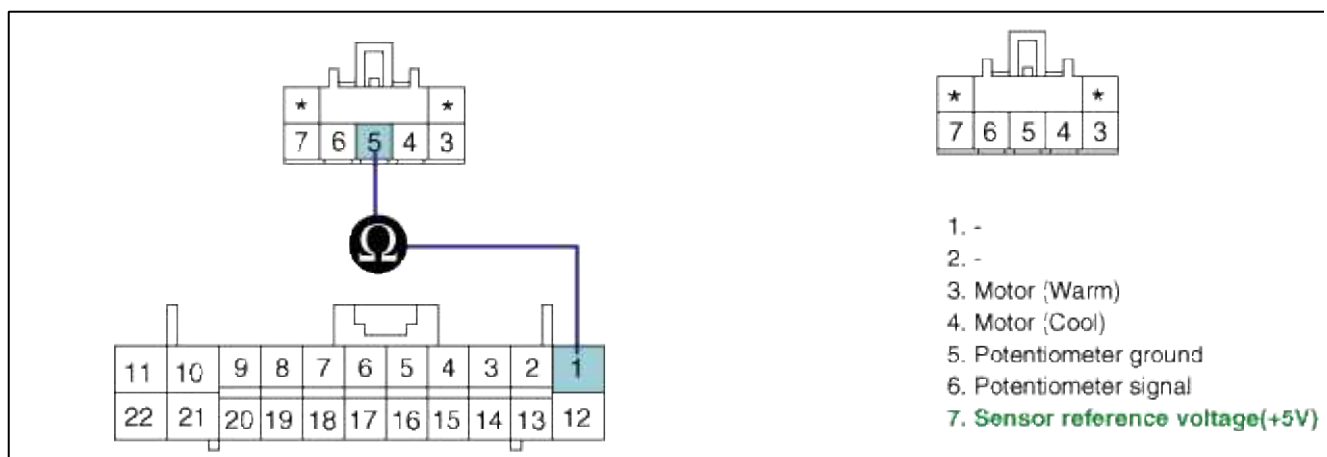
Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

## 1. Check for open in harness.

- (1) Ignition "ON"
- (2) Connect Passenger's Air Mix Potentiometer.
- (3) Measure resistance between terminal "5" of Passenger's Air Mix Potentiometer and terminal "1" A/C control ur

Specification :  $0\Omega$



## (4) Is the measured voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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## SIGNAL CIRCUIT INSPECTION

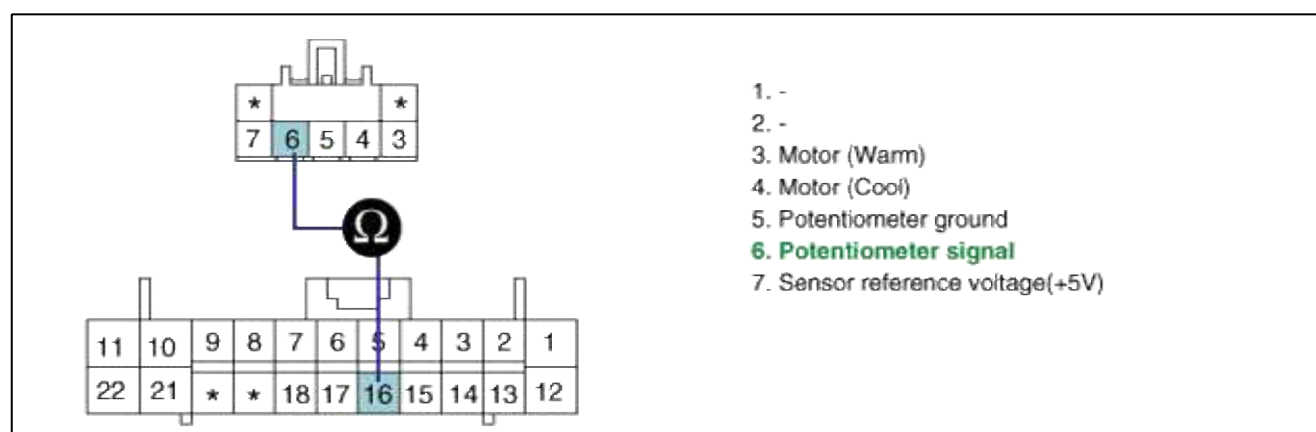
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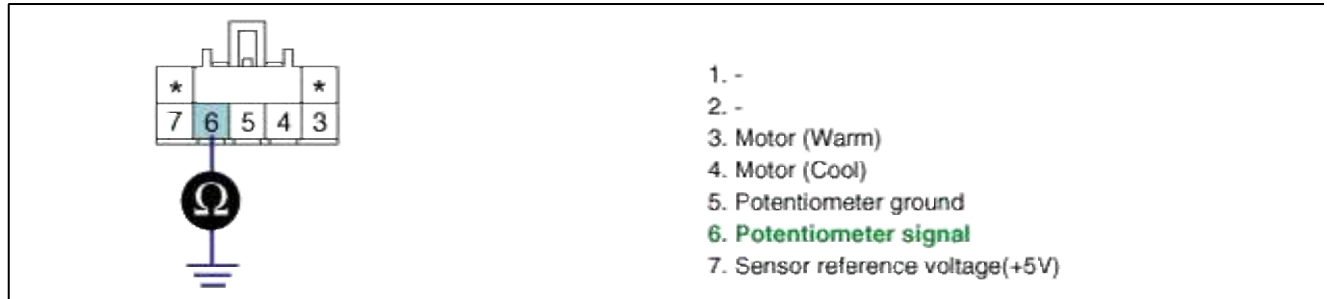
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Passenger's Air Mix potentiometer.
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Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

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**NO**

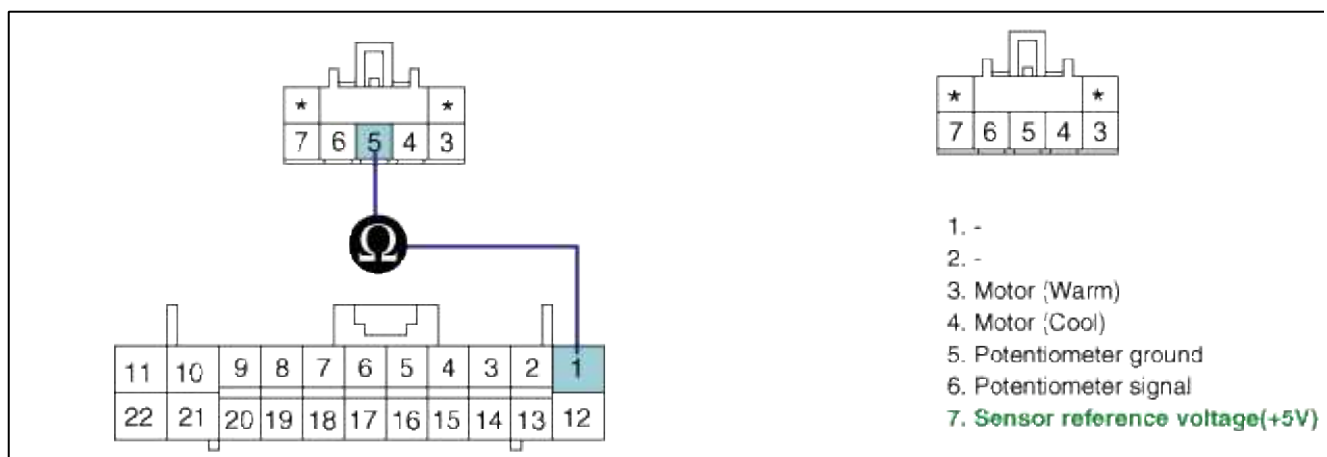
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**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

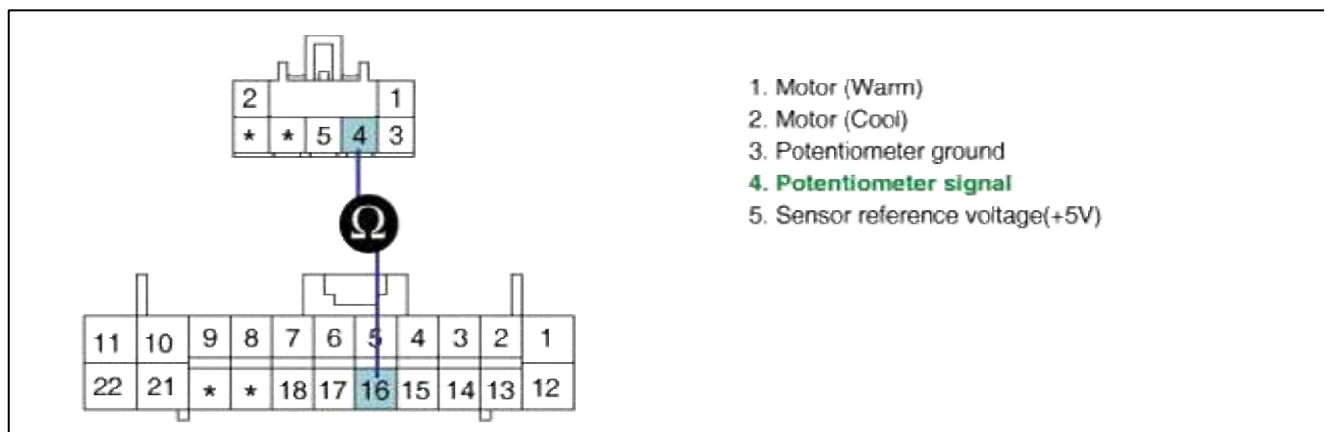
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Passenger's Air Mix potentiometer.

(3) Measure resistance between terminal "4" of Passenger's Air Mix Potentiometer and terminal "16" of A/C contr

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

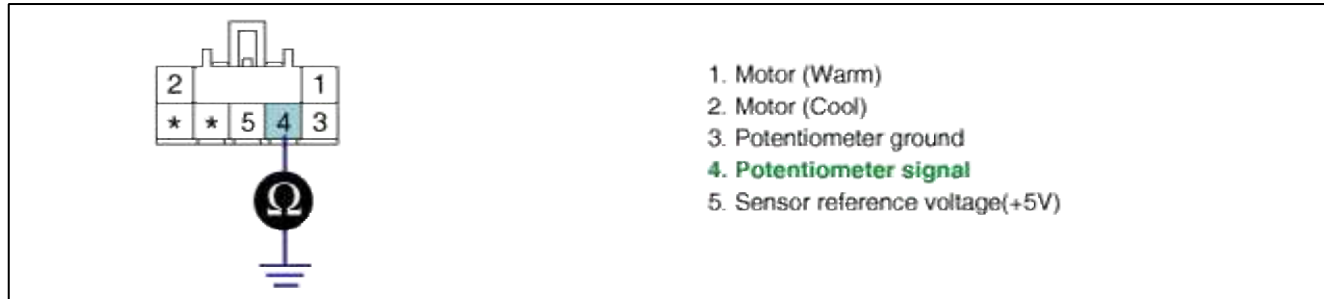
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Passenger's Air Mix potentiometer.
- (3) Measure resistance between terminal "4" of Passenger's Air Mix Potentiometer and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

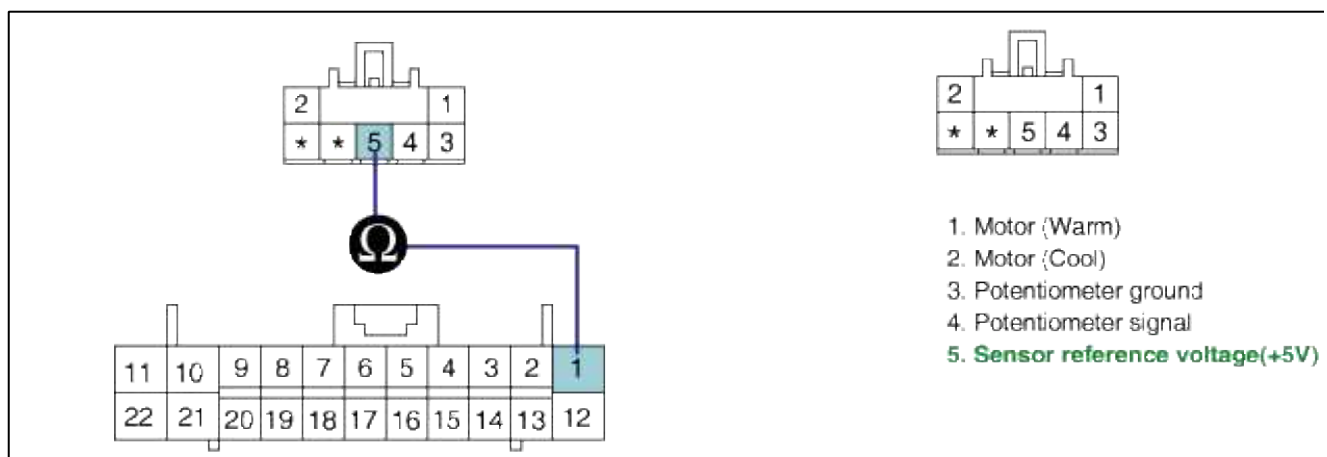
Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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Specification :  $0\Omega$



## (4) Is the measured voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

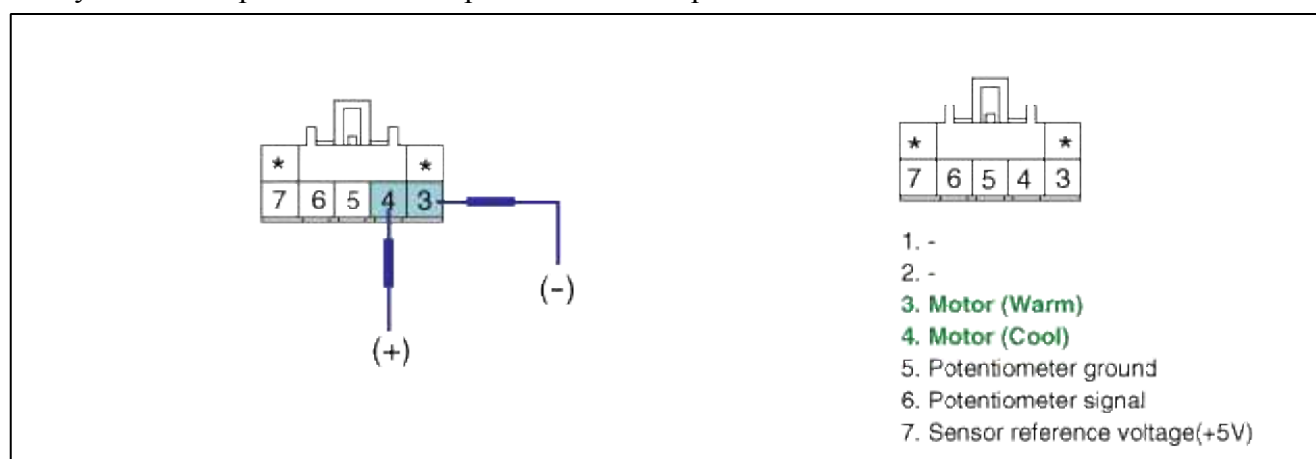
Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.



## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Passenger's Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



## (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

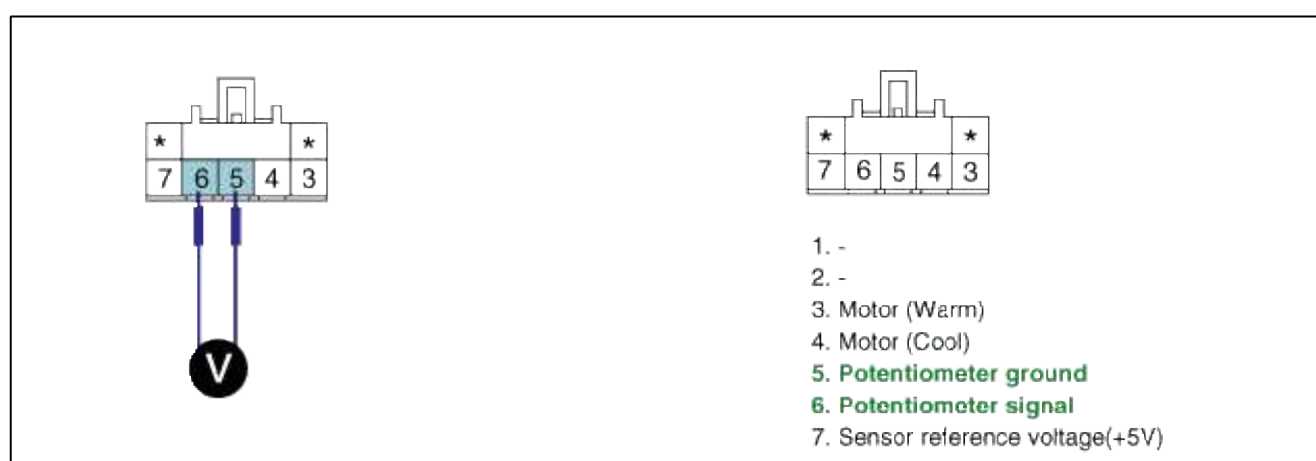
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Passenger's Air Mix potentiometer.
- (3) Measure voltage between terminal "5" and "6" of Passenger's Air Mix potentiometer while operating the temp. switch.

Specification : Refer the specifications in fig 3)



Door position	Voltage (5-6)	Error detecting
MAX. Cooling	$0.3 \pm 0.15\text{V}$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15\text{V}$	High voltage : 4.9V or more

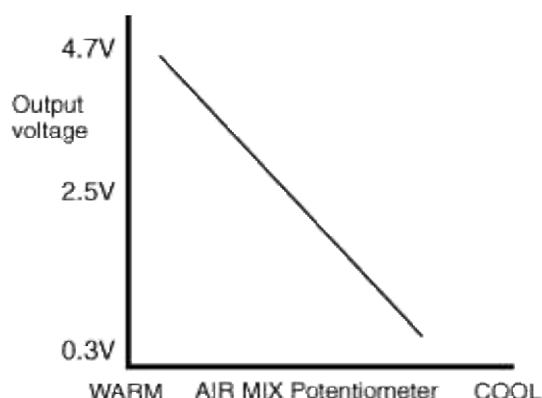


Fig. 3

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

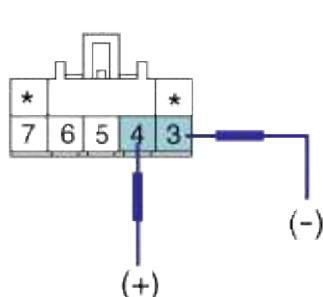
1. Check actuator motor.

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(3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".

(4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



1. -
2. -
3. Motor (Warm)
4. Motor (Cool)
5. Potentiometer ground
6. Potentiometer signal
7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

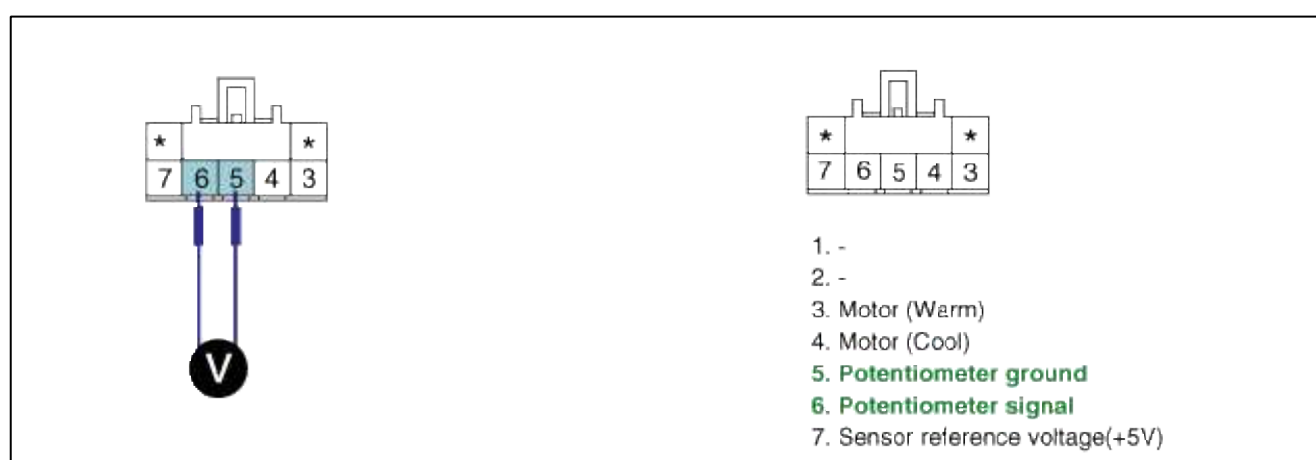
## 2. Check potentiometer

(1) Ignition "ON"

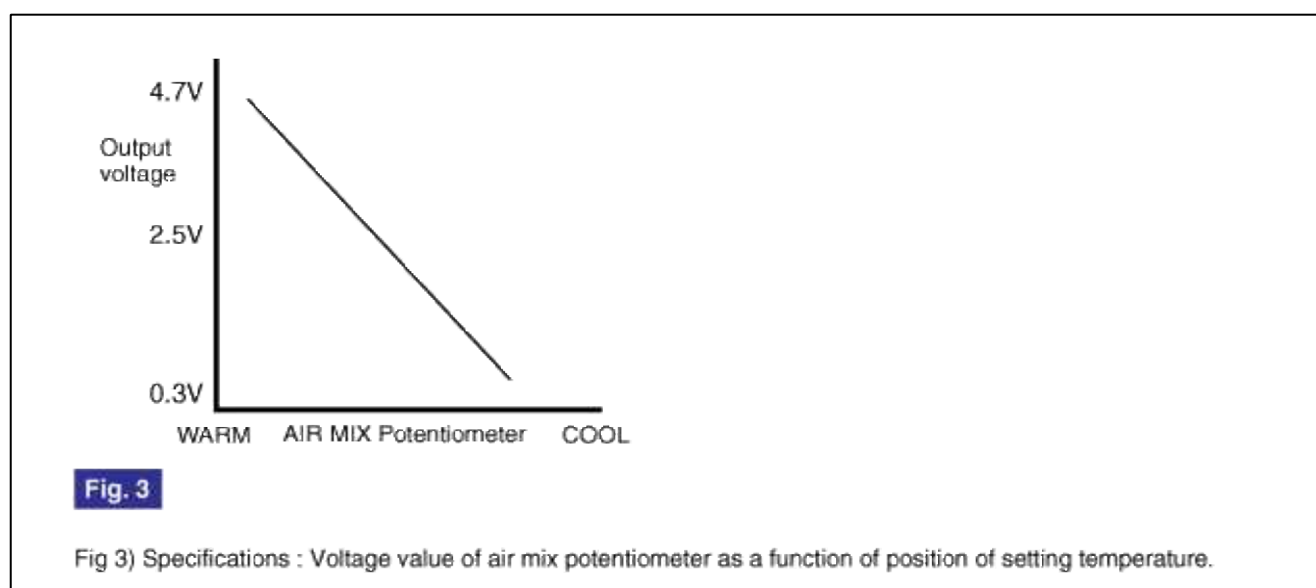
(2) Connect Passenger's Air Mix potentiometer.

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Specification : Refer the specifications in fig 3)



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(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

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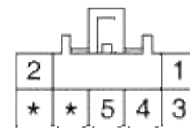
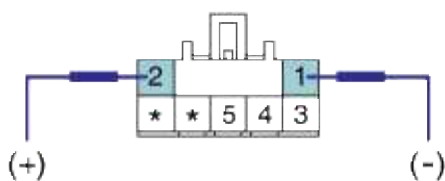
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- 3. Potentiometer ground
- 4. Potentiometer signal
- 5. Sensor reference voltage(+5V)

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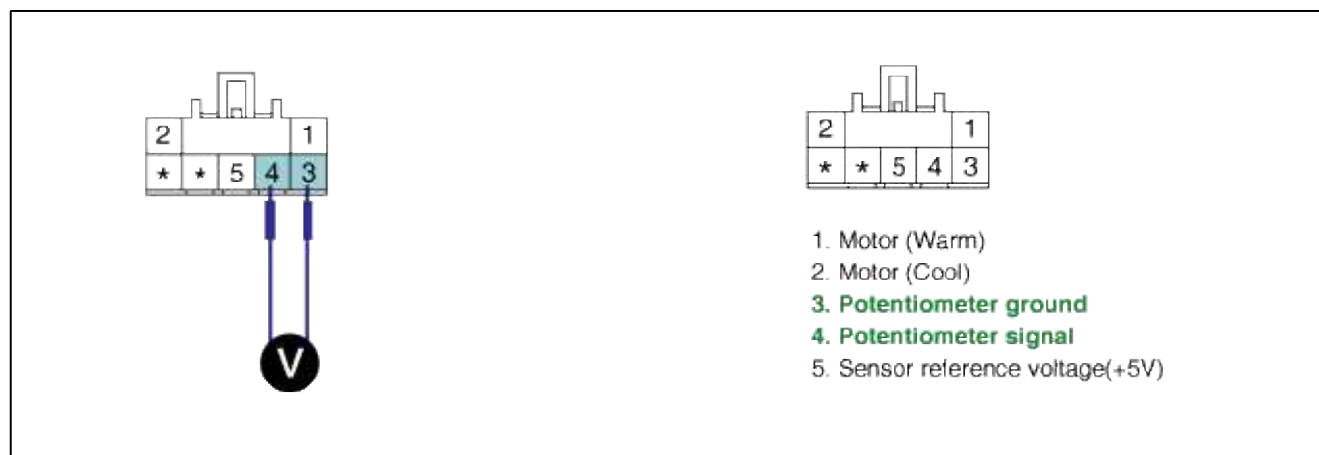
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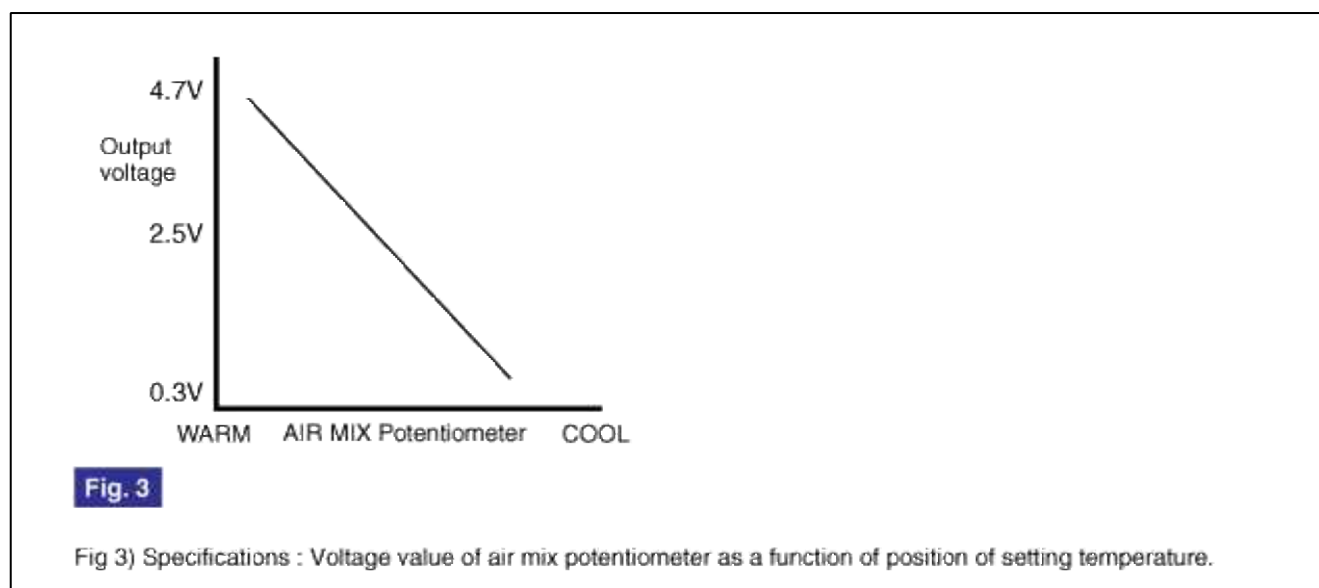
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- (2) Connect Passenger's Air Mix potentiometer.
- (3) Measure voltage between terminal "3" and "4" of Passenger's Air Mix potentiometer while operating the temp. switch.

Specification : Refer the specifications in fig 3)



Door position	Voltage (3-4)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more



- (4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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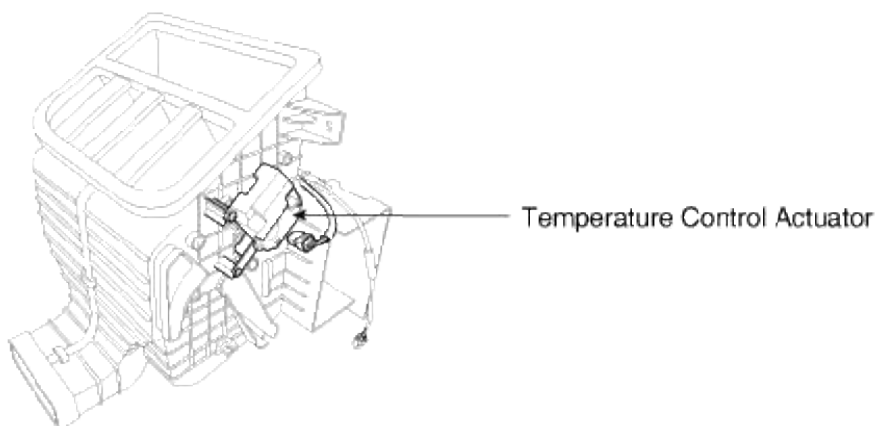
Go to the applicable troubleshooting procedure.

**NO**

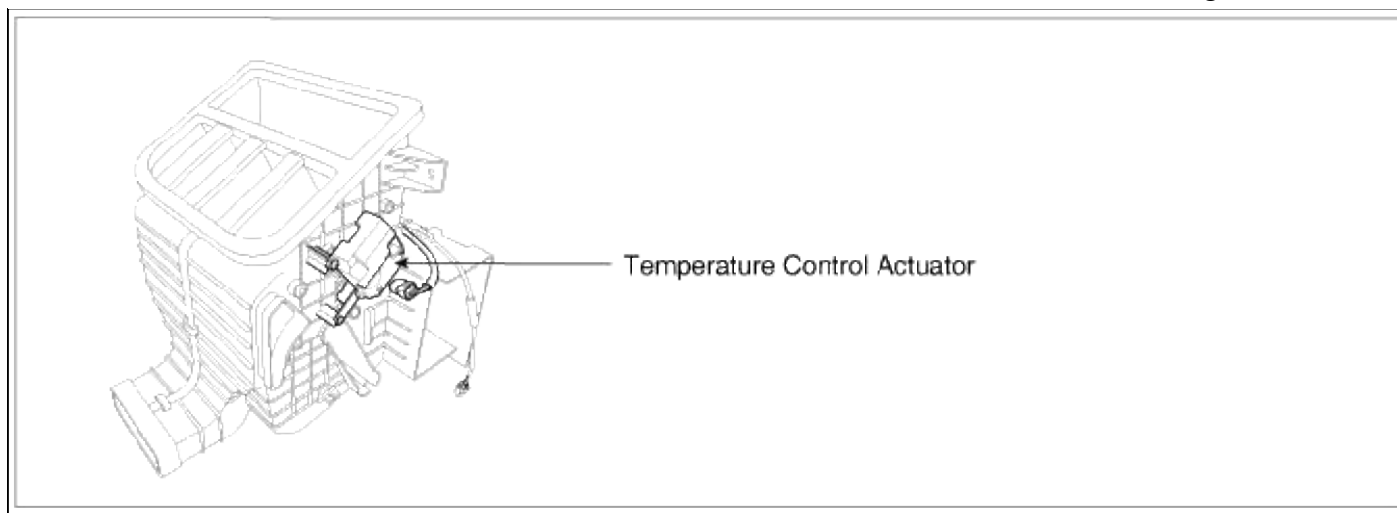
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1205

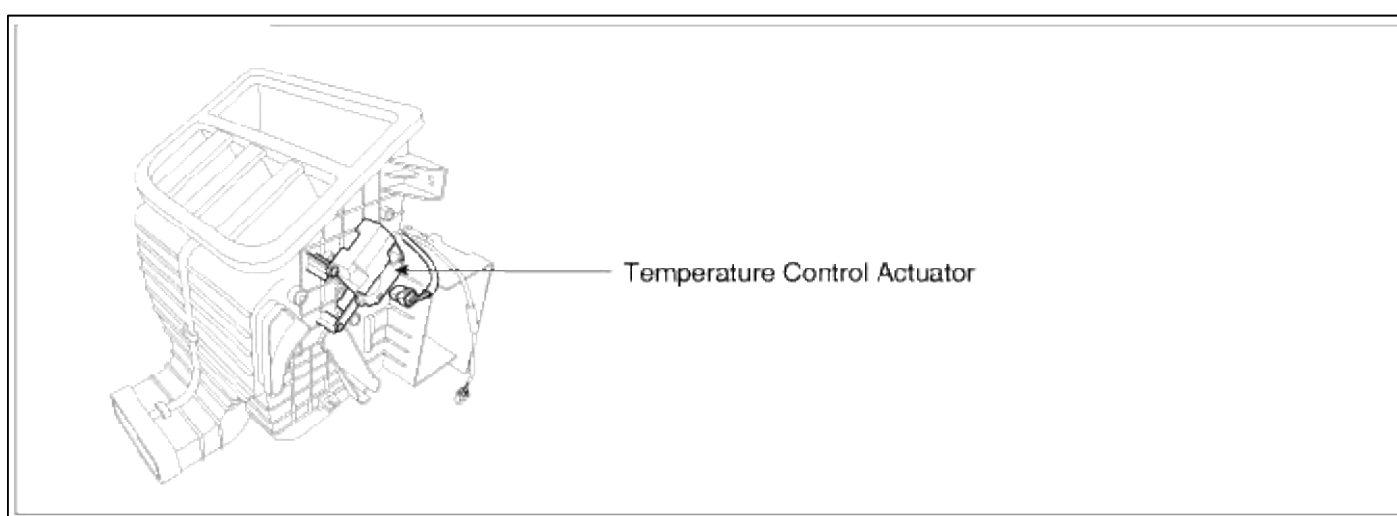
#### COMPONENT LOCATION



#### COMPONENT LOCATION



## COMPONENT LOCATION



## GENERAL DESCRIPTION

Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

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## DTC DESCRIPTION

The A/C controller sets DTC B1205 if there is a short to power in the air mix potentiometer.

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## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> </ul>
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• If temperature setting 17~24.5°C(63~76°F) fix at max. cooling position.</li> <li>• If temperature setting 25~32°C(77~90°F) fix at max. heating position.</li> </ul>	

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Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> </ul>
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• If temperature setting 17~24.5°C(63~76°F) fix at max. cooling position.</li> <li>• If temperature setting 25~32°C(77~90°F) fix at max. heating position.</li> </ul>	

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> </ul>
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• If temperature setting 17~24.5°C(63~76°F) fix at max. cooling position.</li> <li>• If temperature setting 25~32°C(77~90°F) fix at max. heating position.</li> </ul>	

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"



3. Monitor the "Passenger's Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	13.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	12.5 °C	■
DRIVER PHOTO SENSOR	0.00 V	
<b>AIR MIX POPENIO.(PA.)</b>	<b>91.75 %</b>	
DIRECTION POTENIO.DR.	90.18 %	
PASSENGER PHOTO SENSOR	255	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1205.

1.1 DIAGNOSTIC TROUBLE CODES		
<b>B1205 AIR MIX P. - HIGH INPUT</b>		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div></div> <div>HELP</div> </div>		

Fig. 2

4. Are the DTC B1205 present and is parameter of "Passenger's Air Mix potentiometer" fixed?

Parameter of "Passenger's Air Mix potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Passenger's Air Mix potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Passenger's Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	13.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	12.5 °C	■
DRIVER PHOTO SENSOR	0.00 V	
<b>AIR MIX POPENIO.(PA.)</b>	<b>91.75 %</b>	
DIRECTION POTENIO.DR.	90.18 %	
PASSENGER PHOTO SENSOR	255	▼
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Fig 1 : The current data in abnormal state.

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<b>B1205 AIR MIX P. - HIGH INPUT</b>		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div></div> <div>HELP</div> </div>		

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## 4. Are the DTC B1205 present and is parameter of "Passenger's Air Mix potentiometer" fixed?

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1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Passenger's Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	13.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
<b>AIR MIX POPENIO.(PA.)</b>	<b>91.75 %</b>
DIRECTION POTENIO.DR.	90.18 %
PASSENGER PHOTO SENSOR	255

**Fig. 1**

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1205.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1205 AIR MIX P. - HIGH INPUT</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

## 4. Are the DTC B1205 present and is parameter of "Passenger's Air Mix potentiometer" fixed?

Parameter of "Passenger's Air Mix potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Passenger's Air Mix potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.

(1) Ignition "OFF"

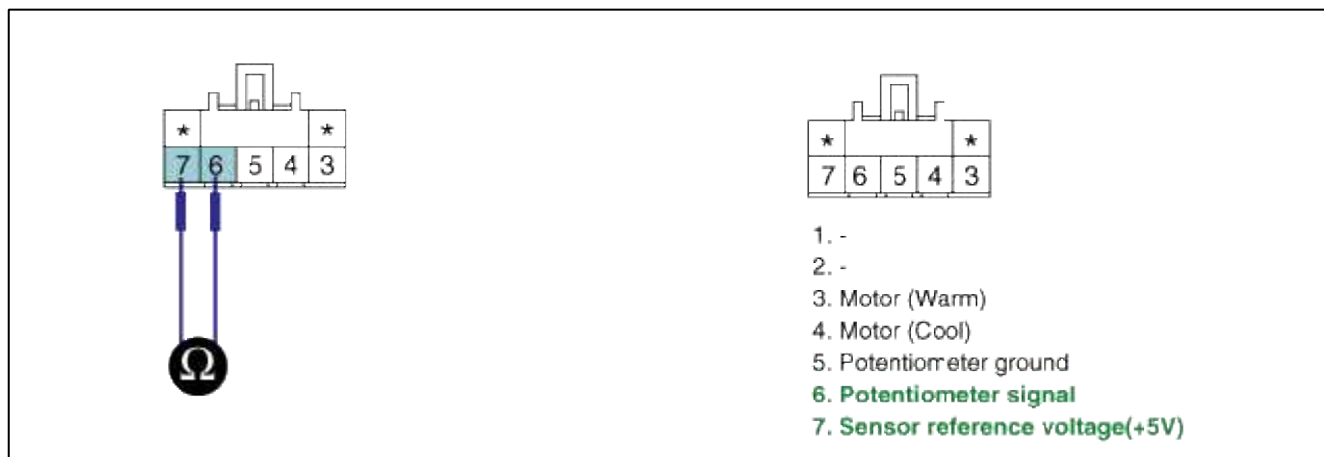
(2) Disconnect Passenger's Air Mix potentiometer.

(3) Measure resistance between terminal "6" and "7" of Passenger's Air Mix potentiometer.

---

Specification : Approx.  $\infty \Omega$

---



(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

**NO**

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

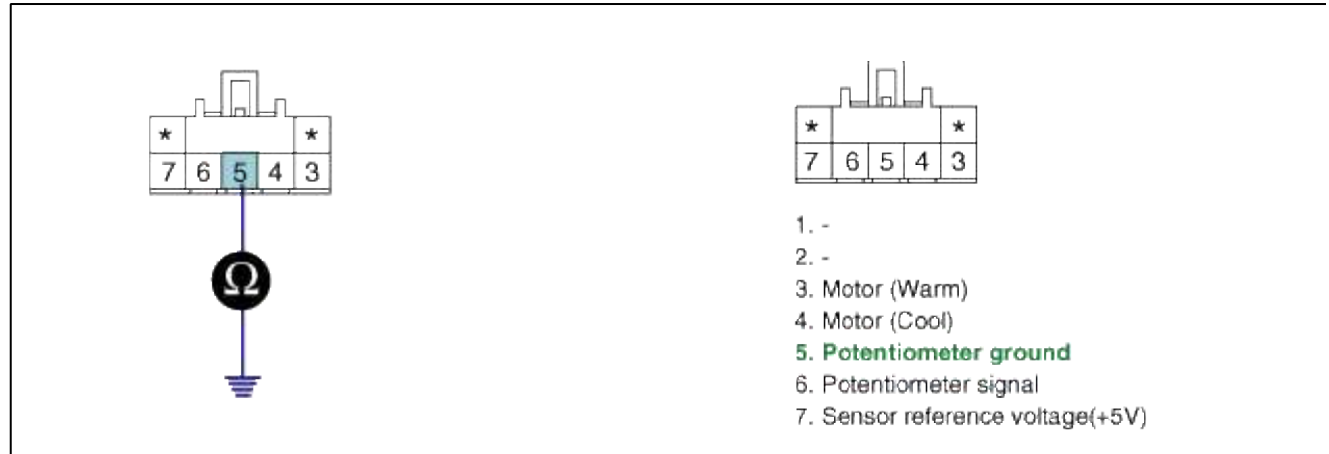
### GROUND CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Passenger's Air Mix Potentiometer.
  - (3) Measure resistance between terminal "5" of Passenger's Air Mix Potentiometer and chassis ground.

---

Specification : Approx. 0  $\Omega$

---



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

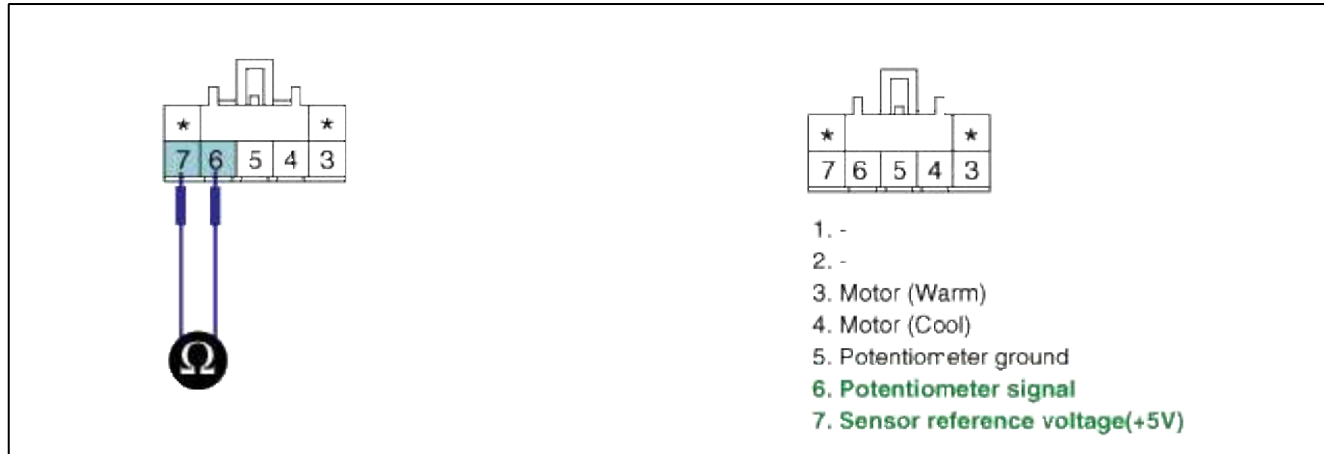
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Passenger's Air Mix potentiometer.
  - (3) Measure resistance between terminal "6" and "7" of Passenger's Air Mix potentiometer.

Specification : Approx.  $\infty \Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

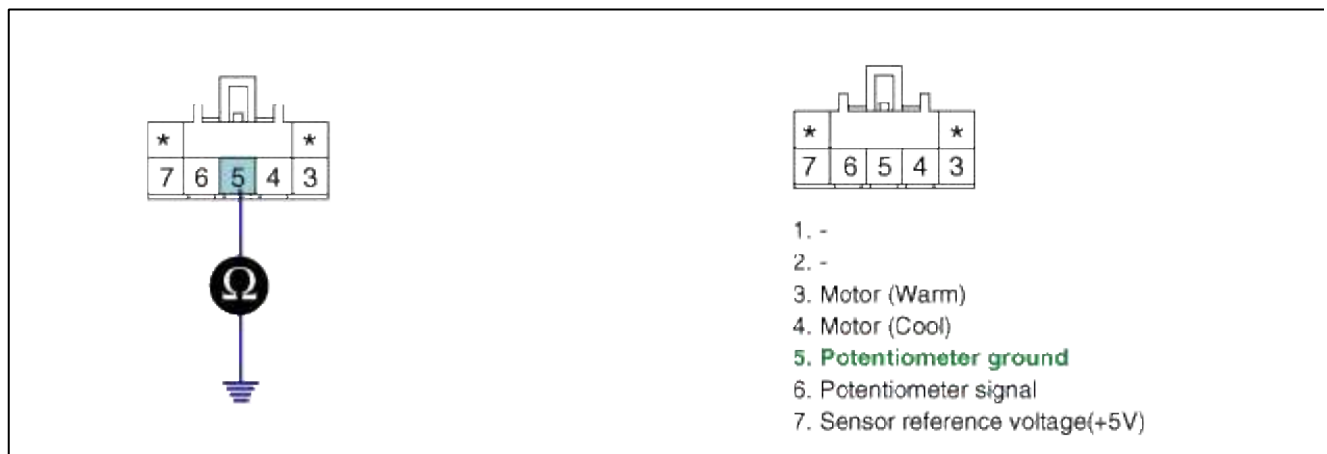
**NO**

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Rep procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Passenger's Air Mix Potentiometer.
  - (3) Measure resistance between terminal "5" of Passenger's Air Mix Potentiometer and chassis ground.

Specification : Approx.  $0 \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

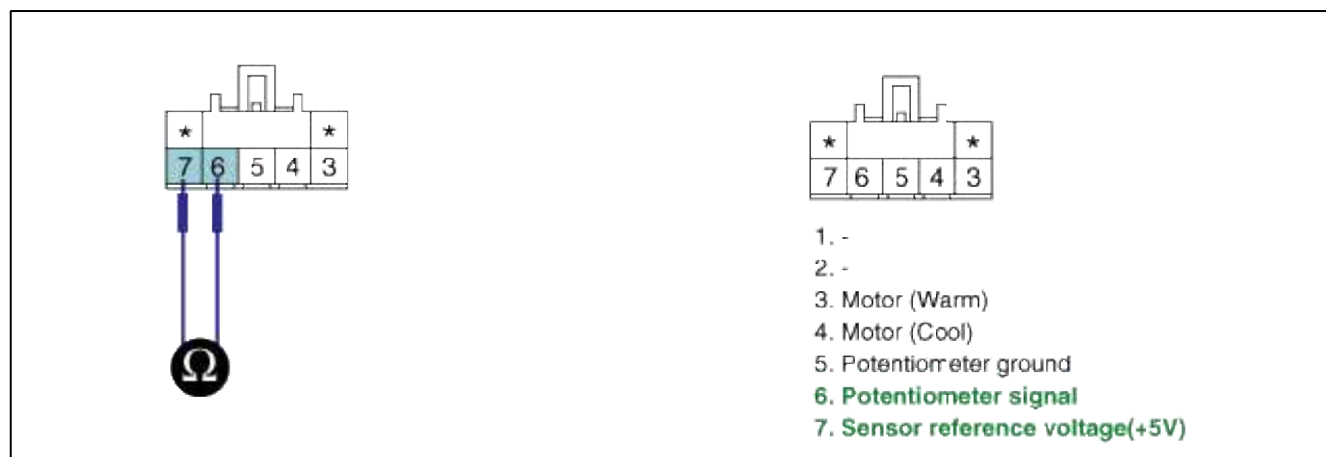
1. Check for short in harness.

(1) Ignition "OFF"

(2) Disconnect Passenger's Air Mix potentiometer.

(3) Measure resistance between terminal "4" and "5" of Passenger's Air Mix potentiometer.

Specification : Approx.  $\infty \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

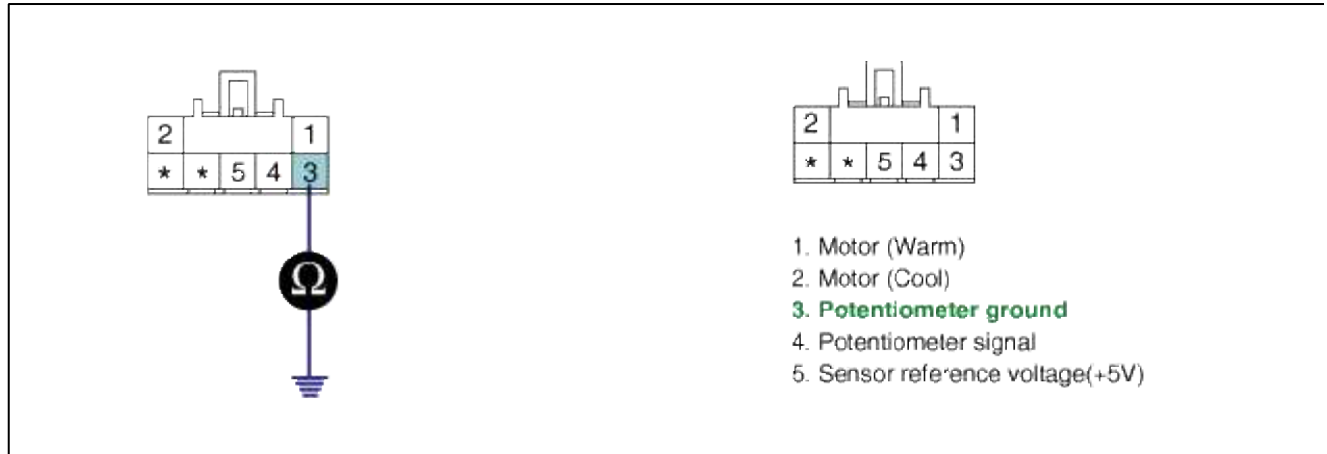
**NO**

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Passenger's Air Mix Potentiometer.
  - (3) Measure resistance between terminal "3" of Passenger's Air Mix Potentiometer and chassis ground.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

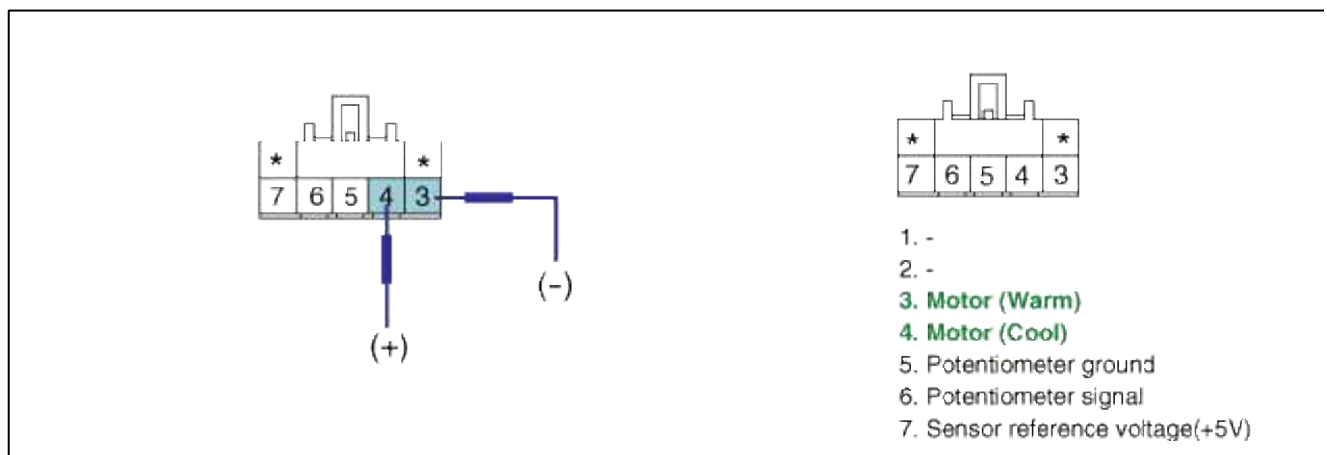
Go to "Component Inspection" procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Check actuator motor.
  - (1) Ignition "OFF"
  - (2) Disconnect Passenger's Air Mix Potentiometer.
  - (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".
  - (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

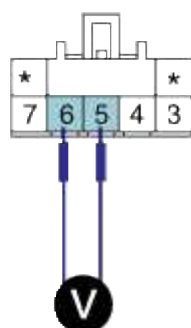
## 2. Check potentiometer

(1) Ignition "ON"

(2) Connect Passenger's Air Mix potentiometer.

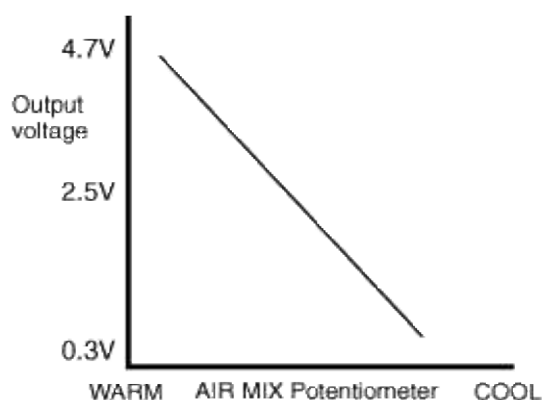
(3) Measure voltage between terminal "5" and "6" of Passenger's Air Mix potentiometer while operating the temp. switch.

Specification : Refer the specifications in fig 3)



- 1. -
- 2. -
- 3. Motor (Warm)
- 4. Motor (Cool)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

Door position	Voltage (5-6)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more



**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.



(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

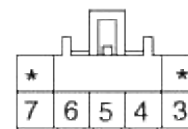
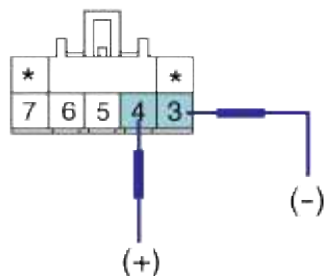
1. Check actuator motor.

(1) Ignition "OFF"

(2) Disconnect Passenger's Air Mix Potentiometer.

(3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".

(4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



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- 2. -
- 3. Motor (Warm)
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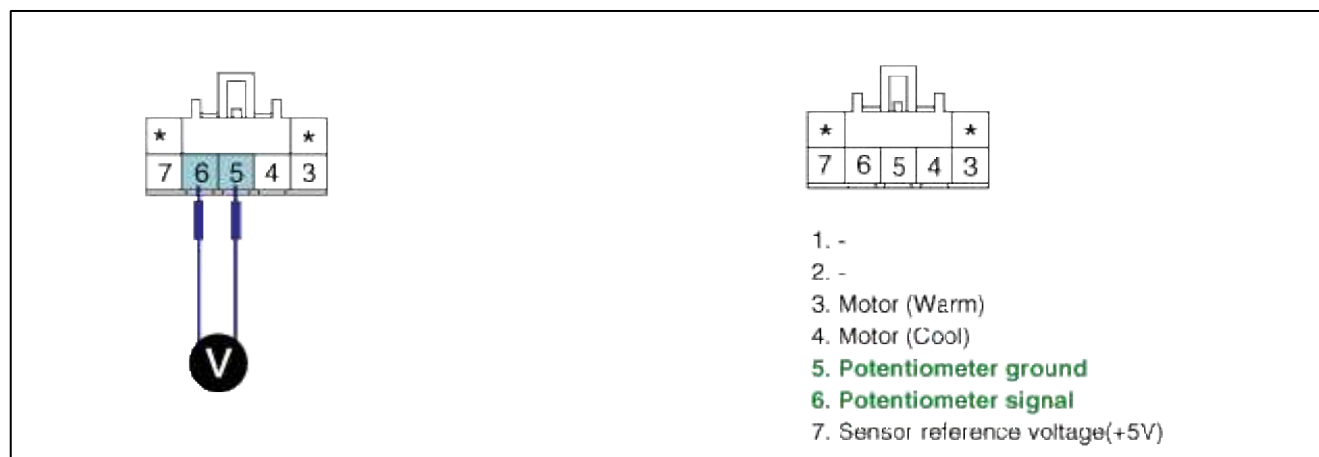
## 2. Check potentiometer

(1) Ignition "ON"

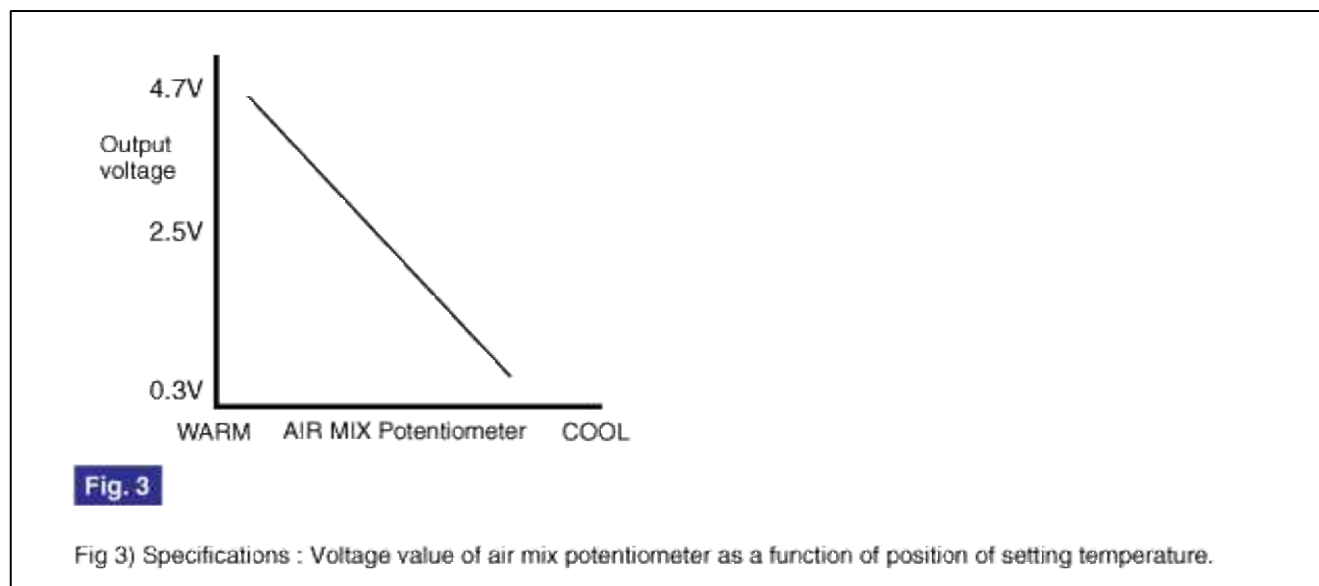
(2) Connect Passenger's Air Mix potentiometer.

(3) Measure voltage between terminal "5" and "6" of Passenger's Air Mix potentiometer while operating the temp. switch.

Specification : Refer the specifications in fig 3)



Door position	Voltage (5-6)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
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(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

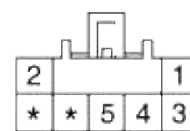
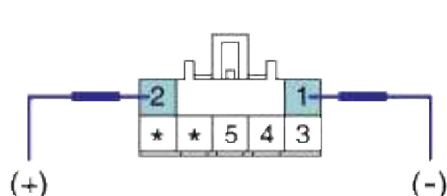
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Passenger's Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "1" and grounding terminal "2".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



1. Motor (Warm)
2. Motor (Cool)
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4. Potentiometer signal
5. Sensor reference voltage(+5V)

## (5) Does the actuator work properly?

YES

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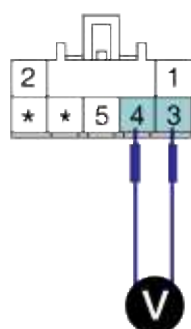
NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Passenger's Air Mix potentiometer.
- (3) Measure voltage between terminal "3" and "4" of Passenger's Air Mix potentiometer while operating the temp. switch.

Specification : Refer the specifications in fig 3)



1. Motor (Warm)
2. Motor (Cool)
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

Door position	Voltage (3-4)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or les
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or mor

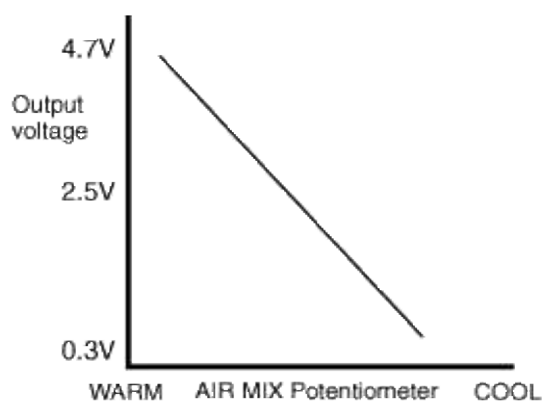
**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

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Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace and then go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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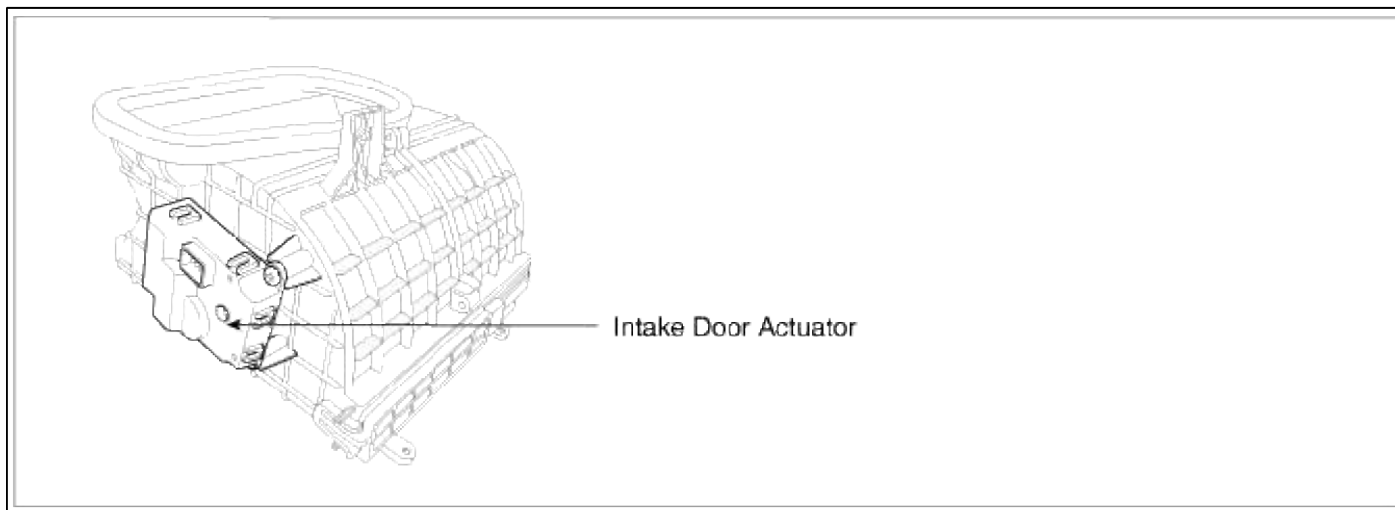
Go to the applicable troubleshooting procedure.

**NO**

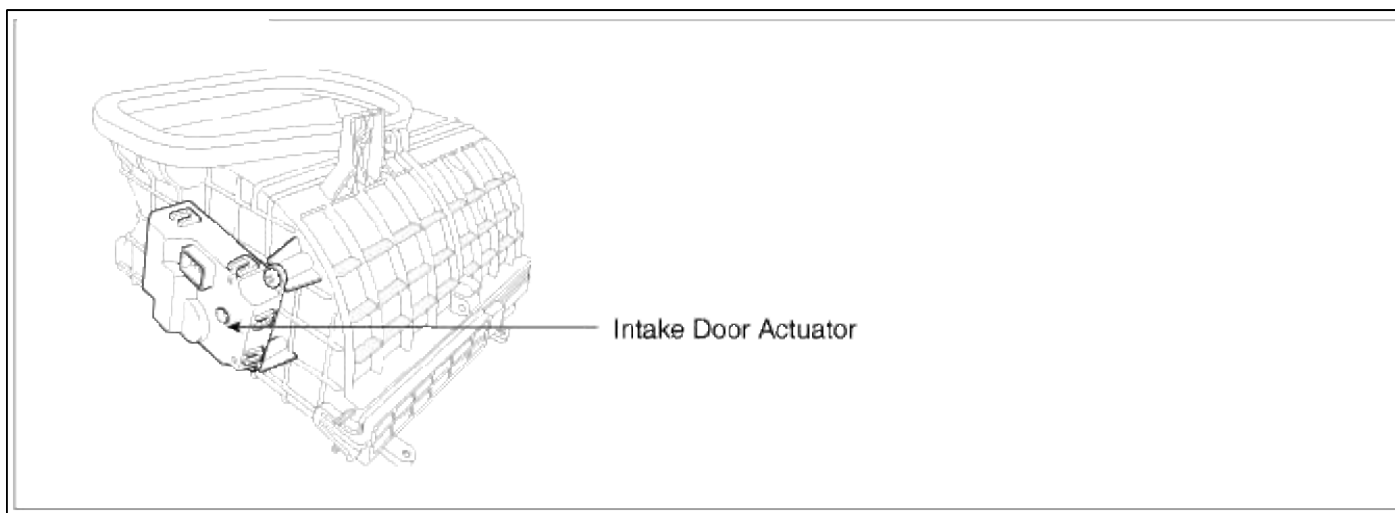
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1208

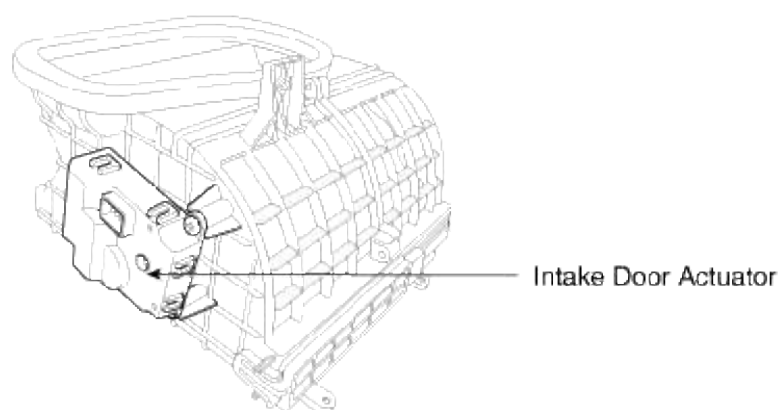
#### COMPONENT LOCATION



#### COMPONENT LOCATION



#### COMPONENT LOCATION



### GENERAL DESCRIPTION

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, A/C controller recirculation receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with fresh mode signal, intake door is closed and with fresh mode signal, intake door is opened).

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### DTC DESCRIPTION

The A/C controller sets DTC B1208 if there is an open circuit or poor connection in the intake potentiometer.

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The A/C controller sets DTC B1208 if there is an open circuit or poor connection in the intake potentiometer.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver intake potentiometer</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• If temperature setting 17~24.5°C(63~76°F) fix at max. cooling position.</li> <li>• Fix at fresh</li> </ul>	

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver intake potentiometer</li> </ul>
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FAIL SAFE	<ul style="list-style-type: none"> <li>• If temperature setting 17~24.5°C(63~76°F) fix at max. cooling position.</li> <li>• Fix at fresh</li> </ul>	

#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Intake Potentiometer" Parameter on the Scantool while operating intake switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO.(DR.)	84.69 %
DIRECTION POTENIO.DR.	51.76 %
PASSENGER PHOTO SENSOR	255
INTAKE SENSOR	6.3 %
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
B1208 INTAKE P. - LOW INPUT	
<div> <div>NUMBER OF DTC : 1 ITEMS</div> </div>	
<div> <div>PART</div> <div>ERAS</div> <div>HELP</div> </div>	

**Fig. 2**

Fig 2 : DTC B1208.

## 4. Are the DTC B1208 present and is parameter of "Intake Potentiometer" fixed?

Parameter of "Intake Potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Intake Potentiometer" Parameter on the Scantool while operating intake switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENATIO.(DR.)	84.69 %
DIRECTION POTENIO.DR.	51.76 %
PASSENGER PHOTO SENSOR	255
<b>INTAKE SENSOR</b>	<b>6.3 %</b>
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

**Fig. 1**

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1208.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1208 INTAKE P. - LOW INPUT</b>
NUMBER OF DTC : 1 ITEMS
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>

**Fig. 2**

## 4. Are the DTC B1208 present and is parameter of "Intake Potentiometer" fixed?

Parameter of "Intake Potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"



3. Monitor the "Intake Potentiometer" Parameter on the Scantool while operating intake switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO.(DR.)	84.69 %
DIRECTION POTENIO.DR.	51.76 %
PASSENGER PHOTO SENSOR	255
<b>INTAKE SENSOR</b>	<b>6.3 %</b>
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1208 INTAKE P. - LOW INPUT</b>
NUMBER OF DTC : 1 ITEMS
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>

**Fig. 2**

Fig 2 : DTC B1208.

4. Are the DTC B1208 present and is parameter of "Intake Potentiometer" fixed?

Parameter of "Intake Potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

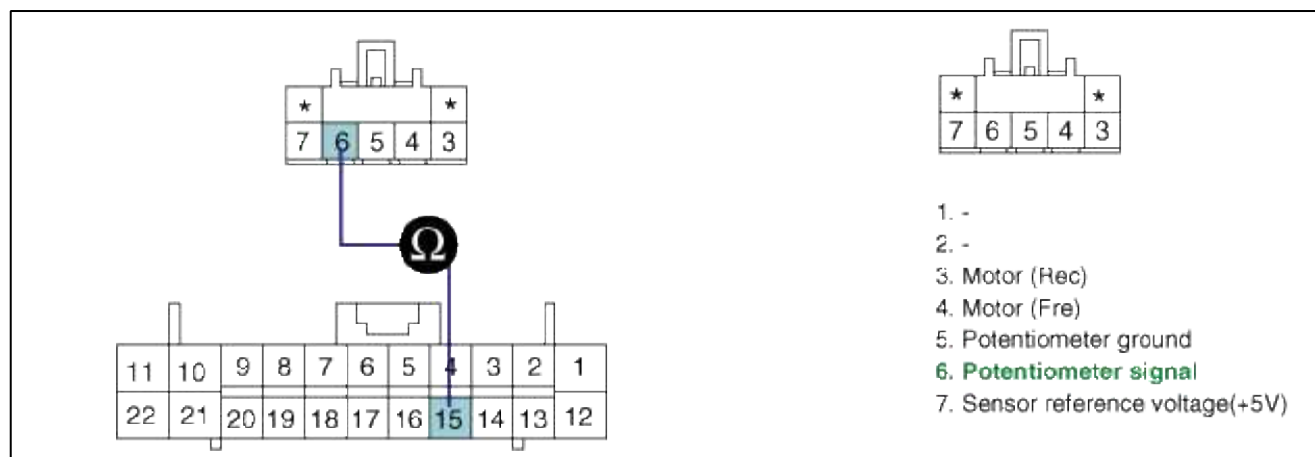
Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

## 1. Check for open in harness.

- (1) Ignition "OFF"
- (2) Disconnect Intake potentiometer.
- (3) Measure resistance between terminal "6" of Intake Potentiometer and terminal "15" of A/C control unit.

Specification : Approx.  $0\ \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

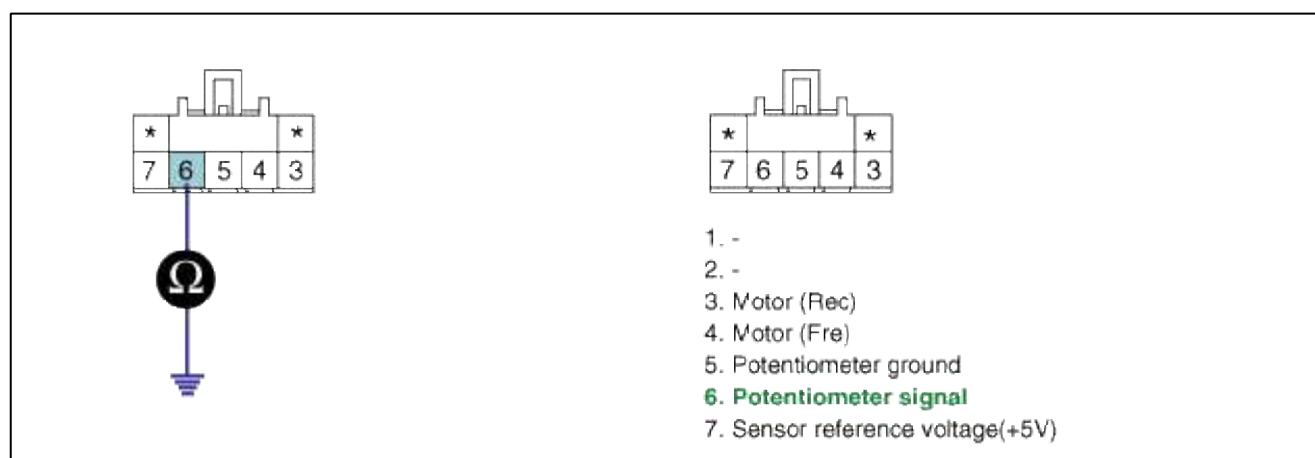
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Intake potentiometer.
- (3) Measure resistance between terminal "6" of Intake Potentiometer and chassis ground.

Specification : Approx.  $\infty\ \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

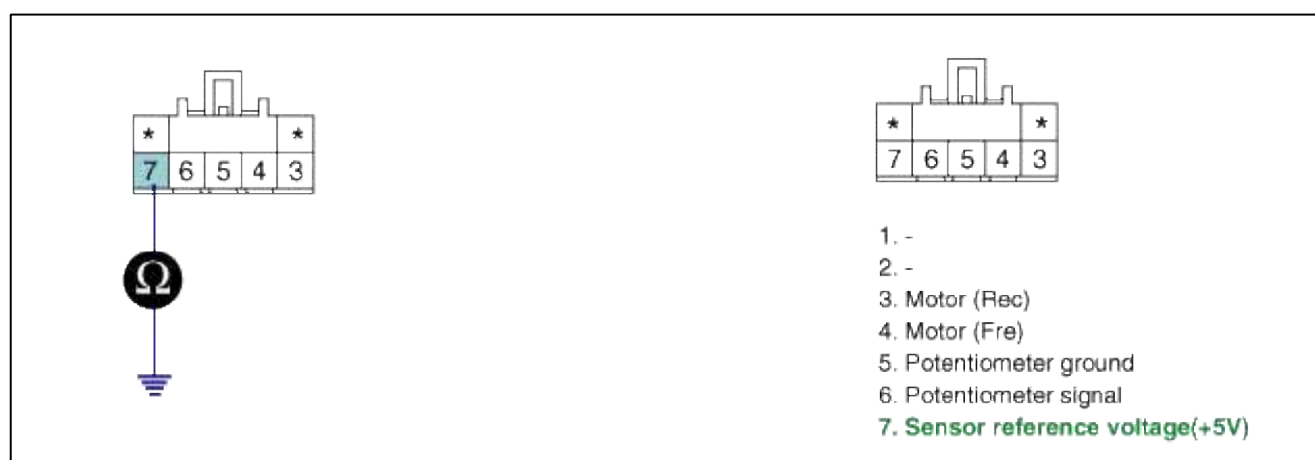
1. Check for short or open in harness.

(1) Ignition "ON"

(2) Connect Intake Potentiometer.

(3) Measure resistance between terminal "7" of Intake Potentiometer and chassis ground.

Specification :  $\infty\Omega$



(4) Is the measured voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

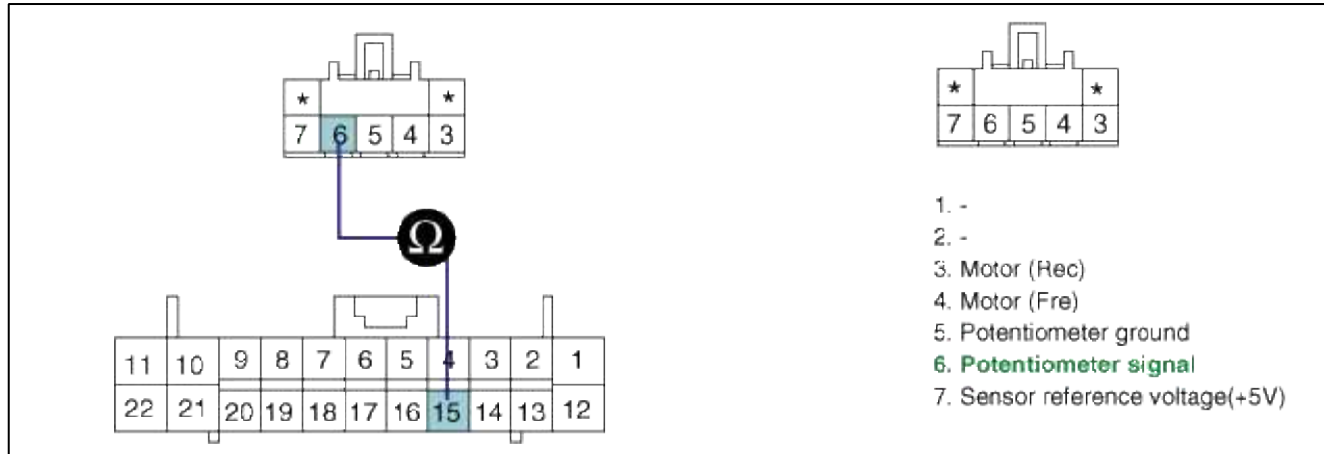
**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Intake potentiometer.
  - (3) Measure resistance between terminal "6" of Intake Potentiometer and terminal "15" of A/C control unit.

Specification : Approx.  $0\ \Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

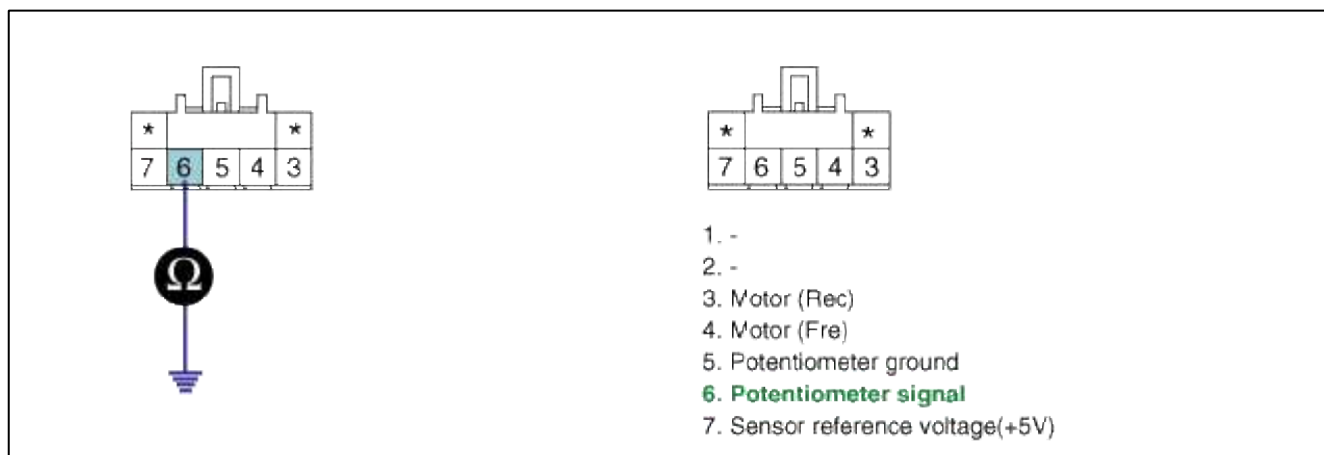
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Intake potentiometer.
- (3) Measure resistance between terminal "6" of Intake Potentiometer and chassis ground.

Specification : Approx.  $\infty\ \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

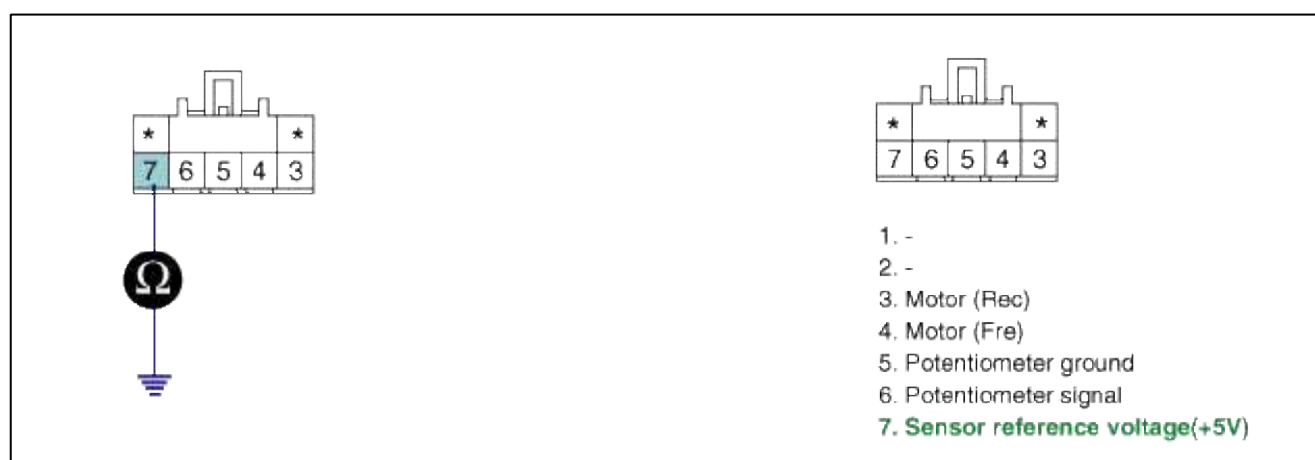
1. Check for short or open in harness.

(1) Ignition "ON"

(2) Connect Intake Potentiometer.

(3) Measure resistance between terminal "7" of Intake Potentiometer and chassis ground.

Specification :  $\infty\Omega$



(4) Is the measured voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

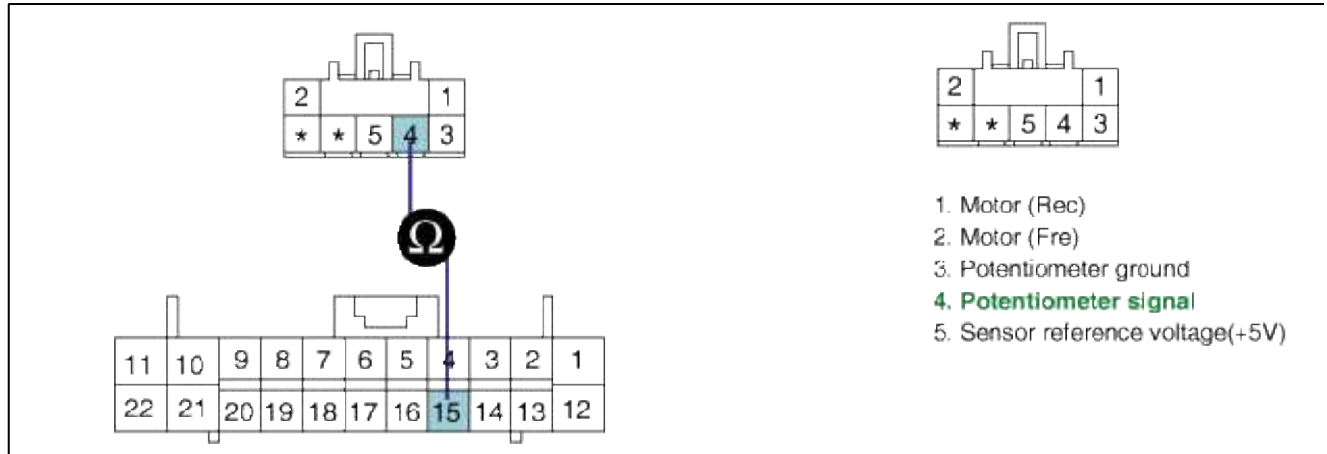
**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Intake potentiometer.
  - (3) Measure resistance between terminal "4" of Intake Potentiometer and terminal "15" of A/C control unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

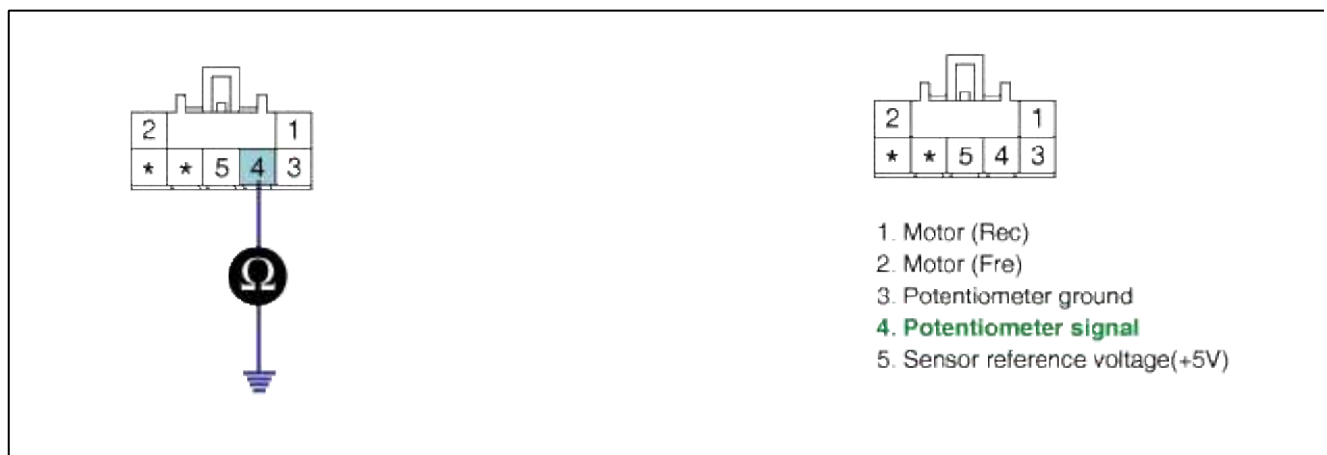
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Intake potentiometer.
- (3) Measure resistance between terminal "4" of Intake Potentiometer and chassis ground.

Specification : Approx.  $\infty$   $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

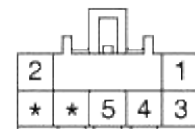
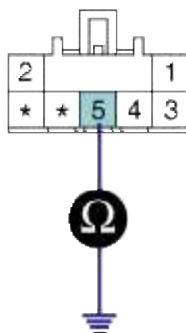
1. Check for short or open in harness.

(1) Ignition "ON"

(2) Connect Intake Potentiometer.

(3) Measure resistance between terminal "5" of Intake Potentiometer and chassis ground.

Specification :  $\infty\Omega$



- 1. Motor (Rec)
- 2. Motor (Fre)
- 3. Potentiometer ground
- 4. Potentiometer signal
- 5. **Sensor reference voltage(+5V)**

(4) Is the measured voltage within specifications?

**YES**

Go to "Component inspection" procedure.

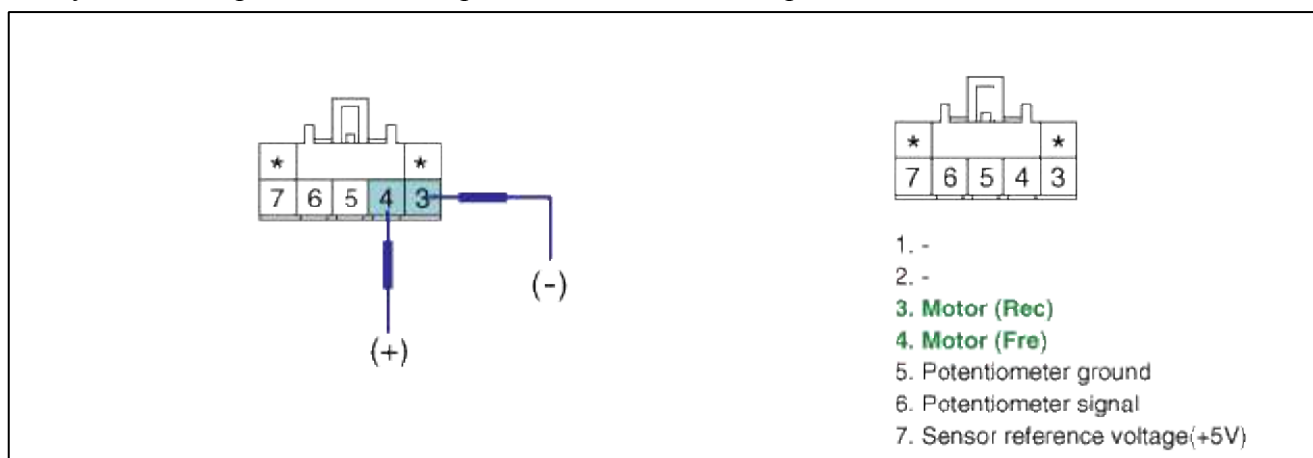
**NO**

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Intake Potentiometer.
- (3) Verify that the temperature actuator operates to the fresh position when connecting 12V to the terminal "3" and grounding terminal "4".
- (4) Verify that the temperature actuator operates to the recirculation position when the connections are reversed.



## (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

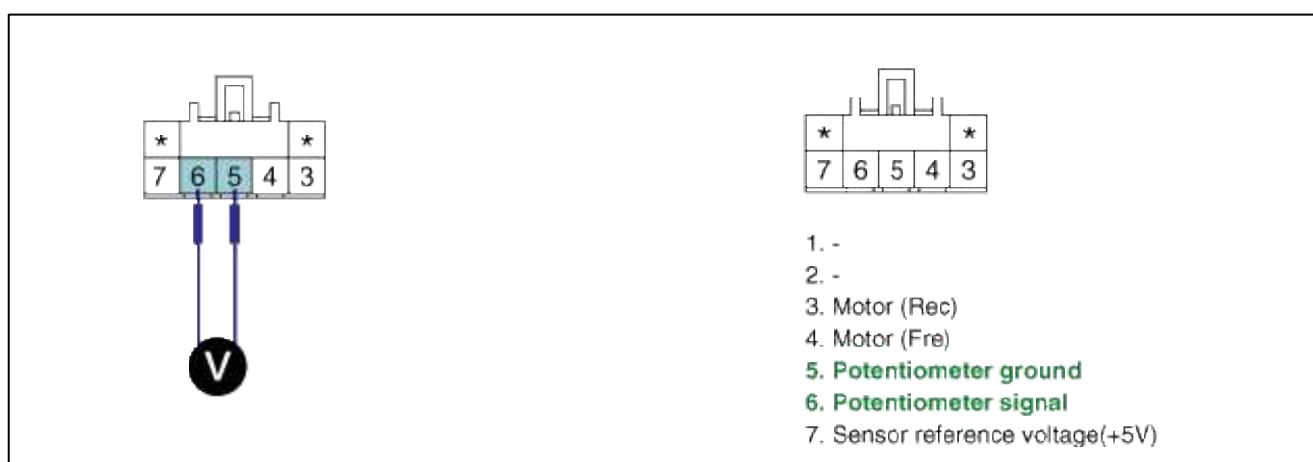
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Intake potentiometer.
- (3) Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch.

Specification : Refer to the specifications



Door position	Voltage (5-6)	Error detecting
Fresh	$0.3 \pm 0.15V$	Low voltage : 0.08V or les
Recirculation	$4.7 \pm 0.15V$	High voltage : 4.9V or mor

Specifications : Voltage value of Intake potentiometer as a function of position of Intake.



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

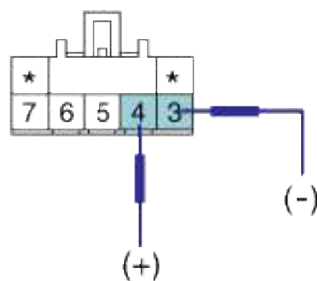
1. Check actuator motor.

(1) Ignition "OFF"

(2) Disconnect Intake Potentiometer.

(3) Verify that the temperature actuator operates to the fresh position when connecting 12V to the terminal "3" and grounding terminal "4".

(4) Verify that the temperature actuator operates to the recirculation position when the connections are reversed.



- 1. -
- 2. -
- 3. Motor (Rec)
- 4. Motor (Fre)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

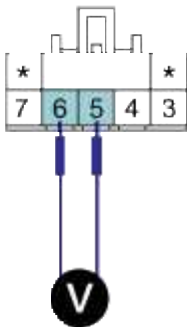
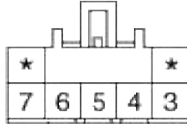
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Intake potentiometer.
- (3) Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch.

Specification : Refer to the specifications

  <ol style="list-style-type: none"> <li>1. -</li> <li>2. -</li> <li>3. Motor (Rec)</li> <li>4. Motor (Fre)</li> <li>5. Potentiometer ground</li> <li>6. Potentiometer signal</li> <li>7. Sensor reference voltage(+5V)</li> </ol>		
Door position	Voltage (5-6)	Error detecting
Fresh	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
Recirculation	$4.7 \pm 0.15V$	High voltage : 4.9V or more

Specifications : Voltage value of Intake potentiometer as a function of position of Intake.

- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

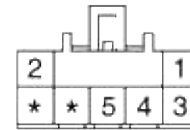
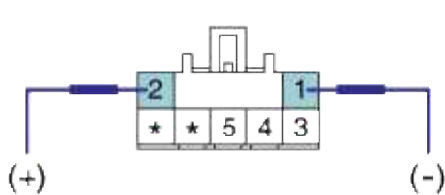
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Intake Potentiometer.
- (3) Verify that the temperature actuator operates to the fresh position when connecting 12V to the terminal "1" and grounding terminal "2".
- (4) Verify that the temperature actuator operates to the recirculation position when the connections are reversed.



- 1. Motor (Rec)
- 2. Motor (Fre)
- 3. Potentiometer ground
- 4. Potentiometer signal
- 5. Sensor reference voltage(+5V)

## (5) Does the actuator work properly?

YES

Go to "Check potentiometer" procedure.

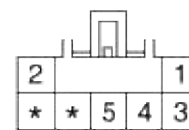
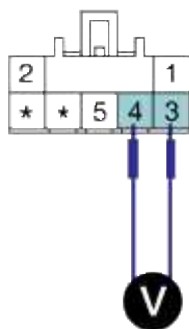
NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Intake potentiometer.
- (3) Measure voltage between terminal "3" and "4" of Intake potentiometer while operating Intake switch.

Specification : Refer to the specifications



- 1. Motor (Rec)
- 2. Motor (Fre)
- 3. Potentiometer ground
- 4. Potentiometer signal
- 5. Sensor reference voltage(+5V)

Door position	Voltage (3-4)	Error detecting
Fresh	$0.3 \pm 0.15V$	Low voltage : 0.08V or les
Recirculation	$4.7 \pm 0.15V$	High voltage : 4.9V or mor

Specifications : Voltage value of Intake potentiometer as a function of position of Intake.

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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3. Are any DTCs present?

**YES**

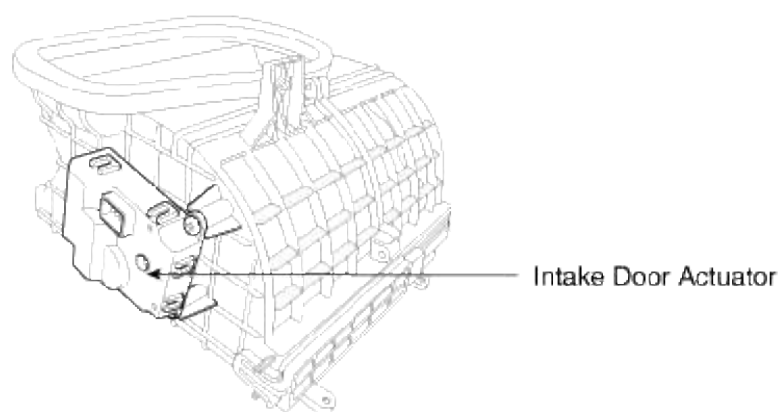
Go to the applicable troubleshooting procedure.

**NO**

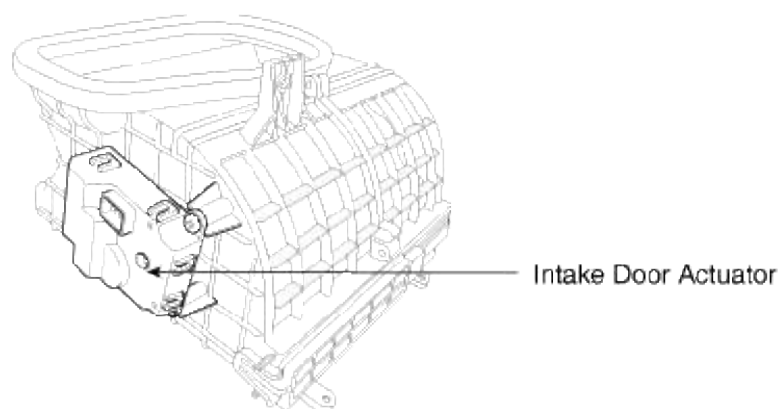
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1209

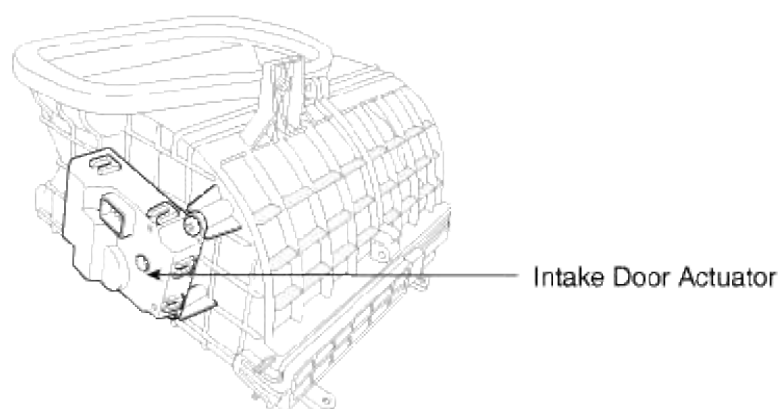
#### COMPONENT LOCATION



## COMPONENT LOCATION



## COMPONENT LOCATION



## GENERAL DESCRIPTION

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, A/C controller recirculation receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with fresh mode signal, intake door is closed and with fresh mode signal, intake door is opened).

## GENERAL DESCRIPTION

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, A/C controller recirculation receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with fresh mode signal, intake door is closed and with fresh mode signal, intake door is opened).

#### GENERAL DESCRIPTION

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, A/C controller recirculation receives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with fresh mode signal, intake door is closed and with fresh mode signal, intake door is opened).

#### DTC DESCRIPTION

The A/C controller sets DTC B1209 if there is a short to power in the Intake potentiometer.

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty Intake potentiometer</li> <li>• Open circuit in harness</li> </ul>
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Fix at fresh	

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Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty Intake potentiometer</li> <li>• Open circuit in harness</li> </ul>
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Fix at fresh	

#### DTC DETECTING CONDITION



### 3. Monitor the "Intake Potentiometer" Parameter on the Scantool while operating Intake switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO.(DR.)	84.69 %
DIRECTION POTENIO.DR.	51.76 %
PASSENGER PHOTO SENSOR	255
<b>INTAKE SENSOR</b>	<b>100.0 %</b>
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1209.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1209 INTAKE P. - HIGH INPUT</b>
NUMBER OF DTC : 1 ITEMS
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>

Fig. 2

### 4. Are the DTC B1209 present and is parameter of "Intake potentiometer" fixed?

Parameter of "Intake potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Intake Potentiometer" Parameter on the Scantool while operating Intake switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO.(DR.)	84.69 %
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<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1209.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1209 INTAKE P. - HIGH INPUT</b>
NUMBER OF DTC : 1 ITEMS
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>

Fig. 2



## 4. Are the DTC B1209 present and is parameter of "Intake potentiometer" fixed?

Parameter of "Intake potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Intake potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

## 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## 3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

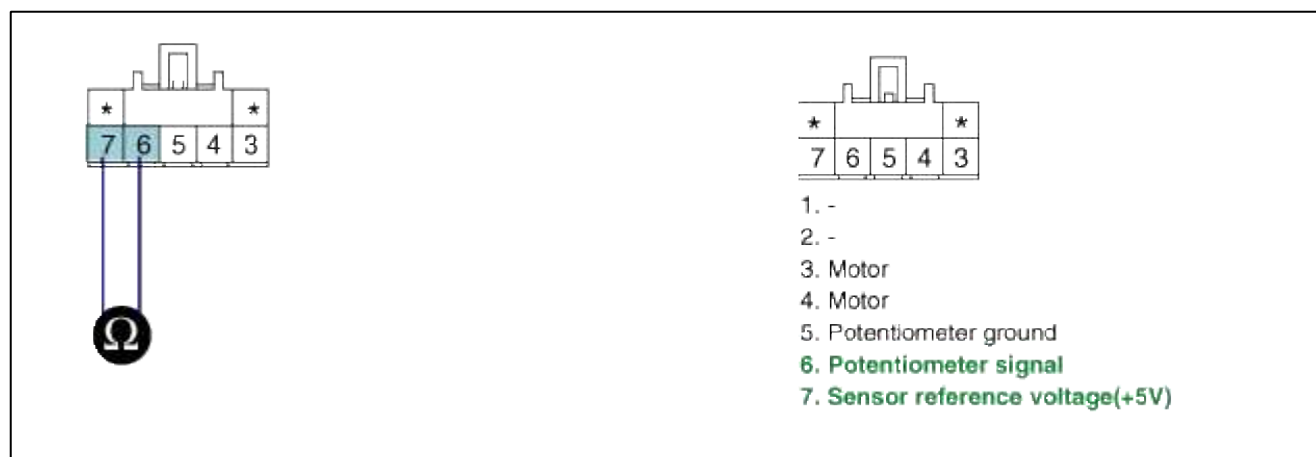
## 1. Check for short in harness.

(1) Ignition "OFF"

(2) Disconnect Intake potentiometer.

(3) Measure resistance between terminal "6" and "7" of Intake potentiometer.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

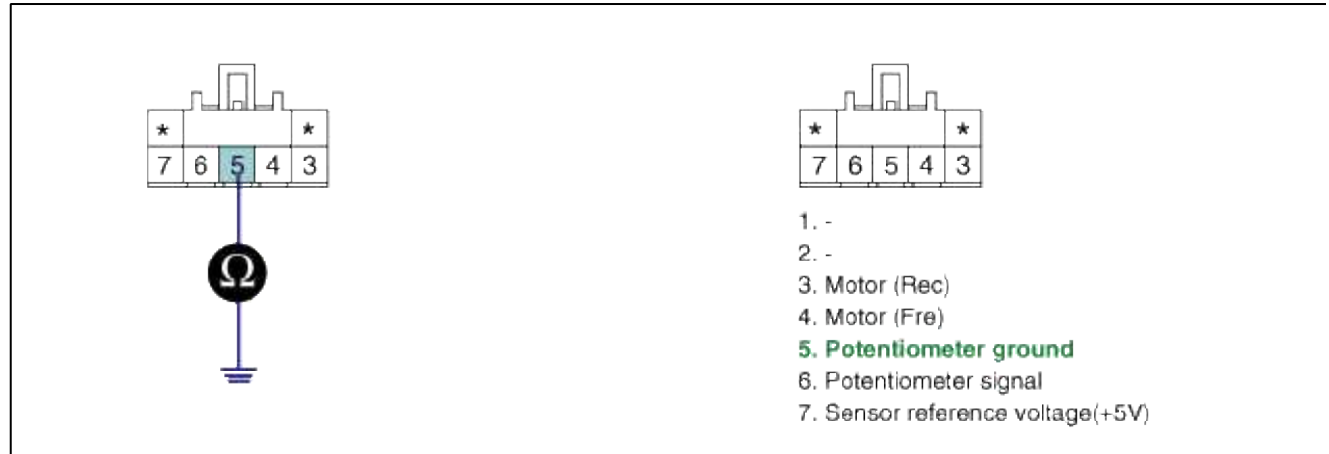
**NO**

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Intake Potentiometer.
  - (3) Measure resistance between terminal "5" of Intake Potentiometer and chassis ground.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

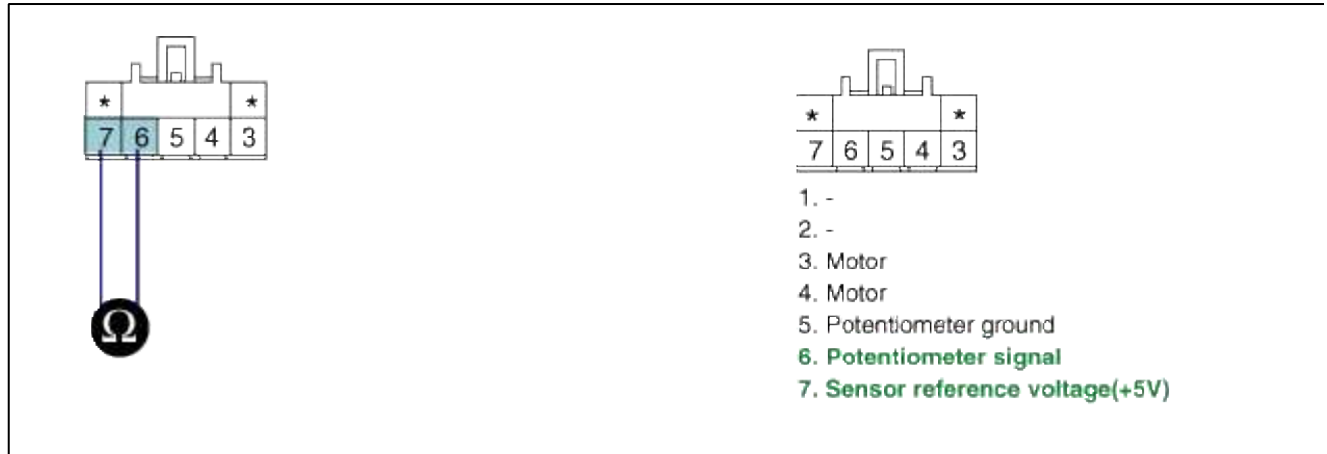
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Intake potentiometer.
  - (3) Measure resistance between terminal "6" and "7" of Intake potentiometer.

Specification : Approx.  $\infty \Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

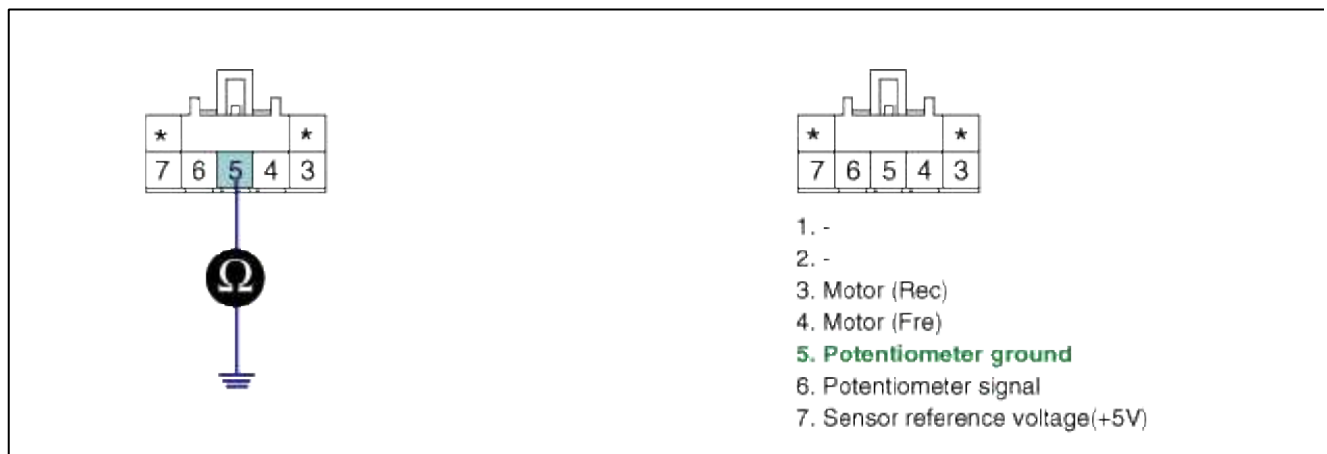
**NO**

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Rep procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Intake Potentiometer.
  - (3) Measure resistance between terminal "5" of Intake Potentiometer and chassis ground.

Specification : Approx.  $0 \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

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**NO**

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## SIGNAL CIRCUIT INSPECTION

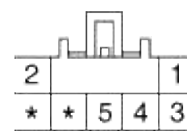
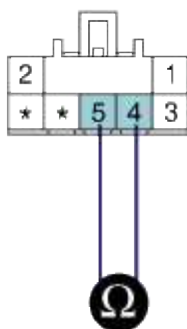
1. Check for short in harness.

(1) Ignition "OFF"

(2) Disconnect Intake potentiometer.

(3) Measure resistance between terminal "4" and "5" of Intake potentiometer.

Specification : Approx.  $\infty \Omega$



- 1. Motor
- 2. Motor
- 3. Potentiometer ground
- 4. Potentiometer signal
- 5. Sensor reference voltage(+5V)

(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

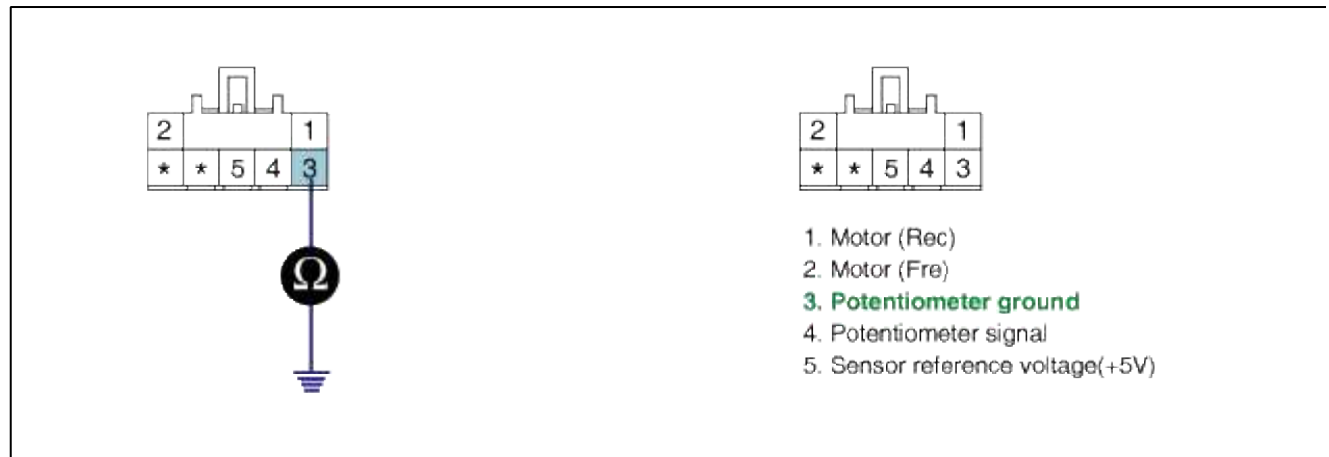
**NO**

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Intake Potentiometer.
  - (3) Measure resistance between terminal "3" of Intake Potentiometer and chassis ground.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

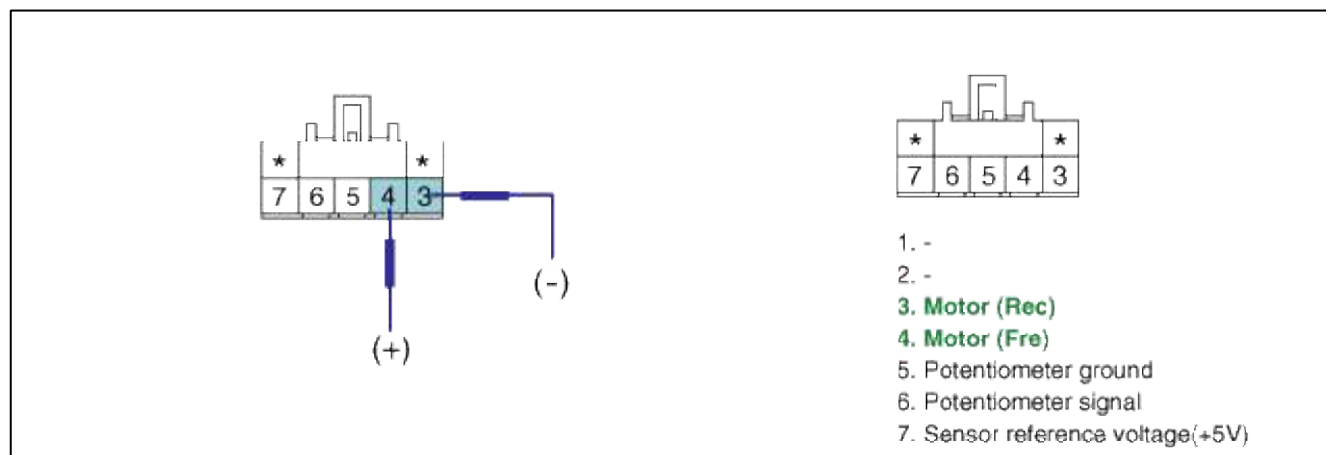
Go to "Component Inspection" procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Check actuator motor.
  - (1) Ignition "OFF"
  - (2) Disconnect Intake Potentiometer.
  - (3) Verify that the temperature actuator operates to the fresh position when connecting 12V to the terminal "3" and grounding terminal "4".
  - (4) Verify that the temperature actuator operates to the recirculation position when the connections are reversed.



(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

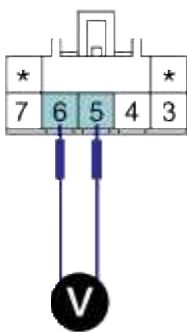
## 2. Check potentiometer

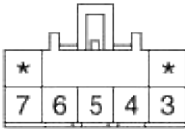
(1) Ignition "ON"

(2) Connect Intake potentiometer.

(3) Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch.

Specification : Refer to the specifications





1. -  
2. -  
3. Motor (Rec)  
4. Motor (Fre)  
**5. Potentiometer ground**  
**6. Potentiometer signal**  
7. Sensor reference voltage(+5V)

Door position	Voltage (5-6)	Error detecting
Fresh	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
Recirculation	$4.7 \pm 0.15V$	High voltage : 4.9V or more

Specifications : Voltage value of Intake potentiometer as a function of position of Intake.

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

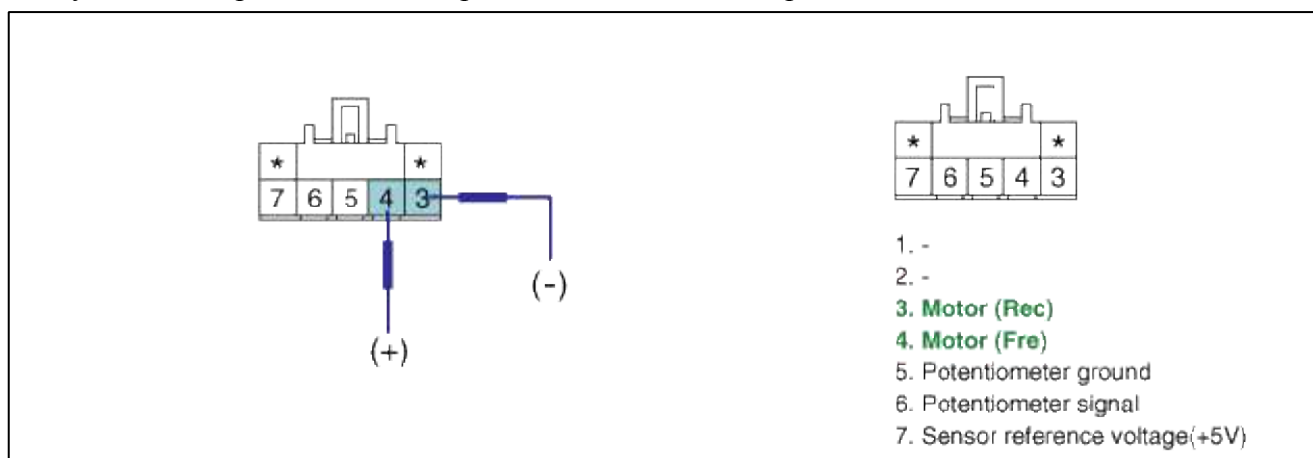
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

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- (1) Ignition "OFF"
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## (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

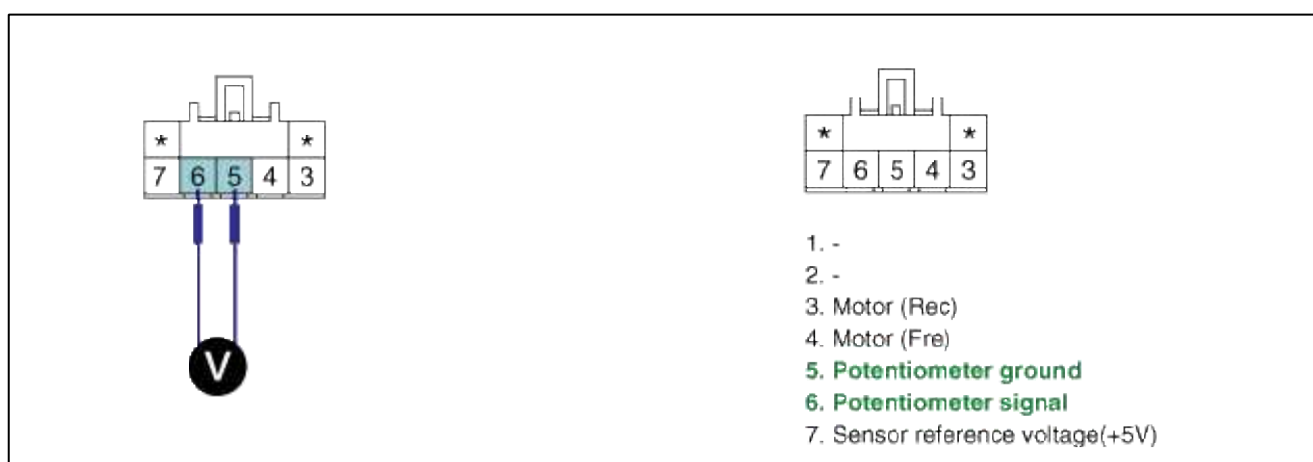
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Intake potentiometer.
- (3) Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch.

Specification : Refer to the specifications



Door position	Voltage (5-6)	Error detecting
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**NO**

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## COMPONENT INSPECTION

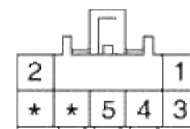
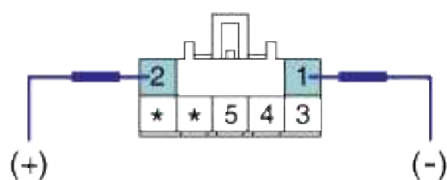
1. Check actuator motor.

(1) Ignition "OFF"

(2) Disconnect Intake Potentiometer.

(3) Verify that the temperature actuator operates to the fresh position when connecting 12V to the terminal "1" and grounding terminal "2".

(4) Verify that the temperature actuator operates to the recirculation position when the connections are reversed.



- 1. Motor (Rec)
- 2. Motor (Fre)
- 3. Potentiometer ground
- 4. Potentiometer signal
- 5. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

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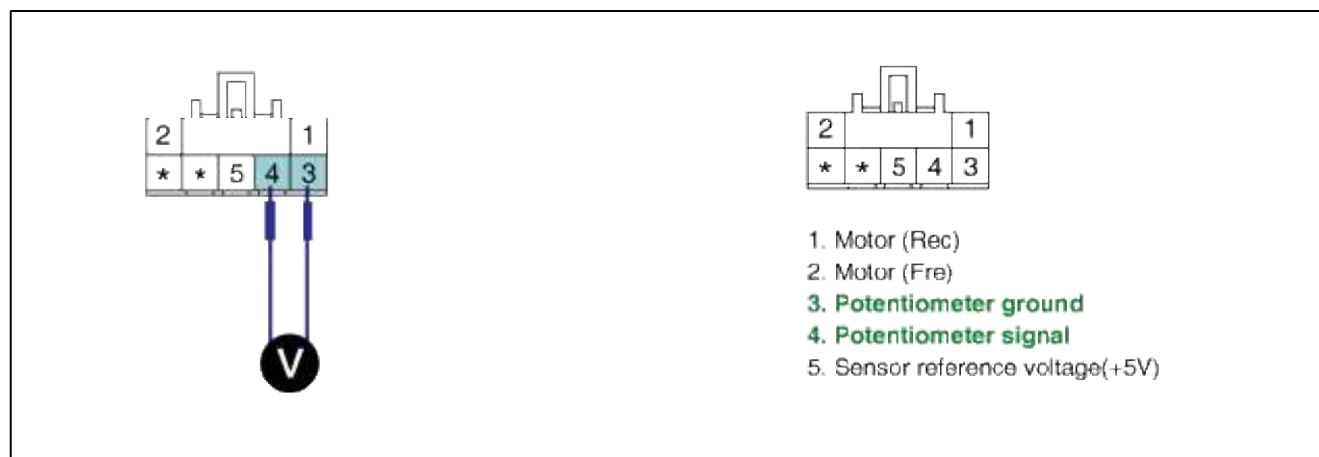
Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.



## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Intake potentiometer.
- (3) Measure voltage between terminal "3" and "4" of Intake potentiometer while operating Intake switch.

Specification : Refer to the specifications



Door position	Voltage (3-4)	Error detecting
Fresh	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
Recirculation	$4.7 \pm 0.15V$	High voltage : 4.9V or more

Specifications : Voltage value of Intake potentiometer as a function of position of Intake.

## (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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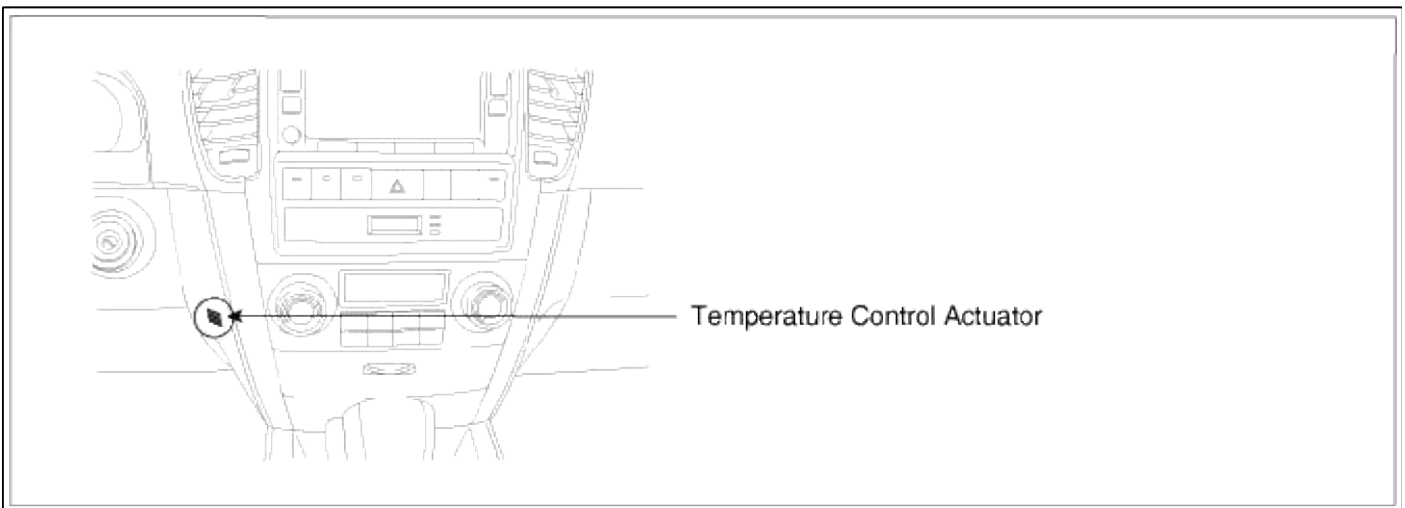
Go to the applicable troubleshooting procedure.

**NO**

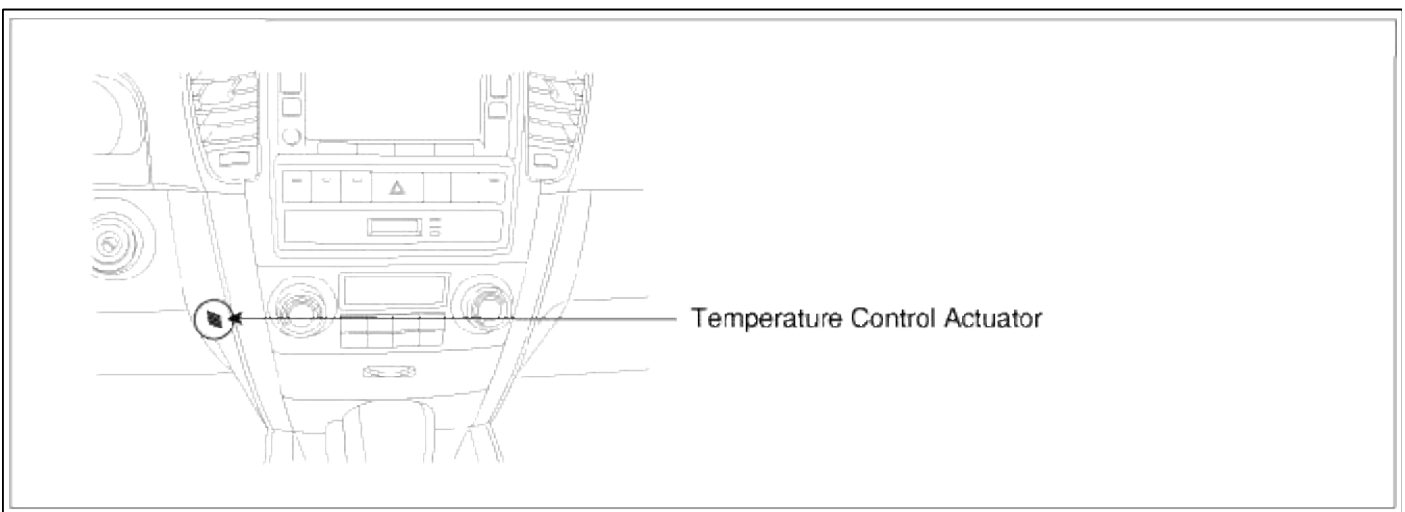
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1233

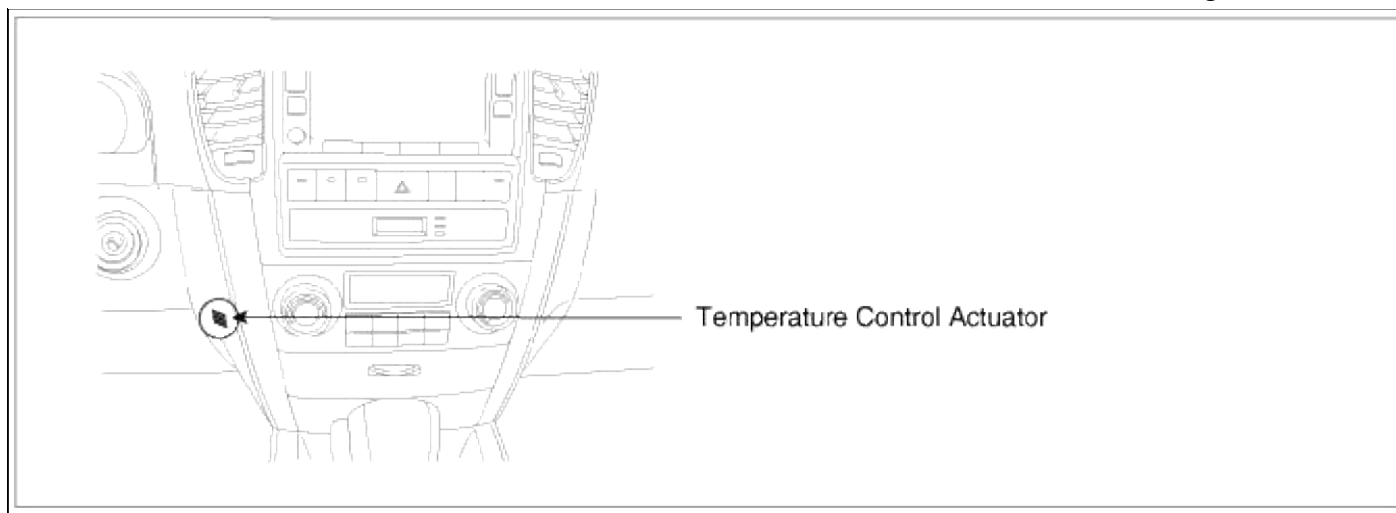
#### COMPONENT LOCATION



#### COMPONENT LOCATION



#### COMPONENT LOCATION



#### GENERAL DESCRIPTION

The incar temperature sensor located at crush pad, control unit contains a thermistor which measures the temperature of the inside. The signal, decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal, the control unit regulates incar temperature to intended value.

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#### DTC DESCRIPTION

The A/C controller sets DTC B1233 if there is a short circuit in incar temp. sensor signal harness or the measured resistance value of sensor is less than threshold value(about 7.46k $\Omega$ )

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty incar temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• < 7.46 k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 25°C(77°F)	

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Threshold value	• < 7.46 kΩ	
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Threshold value	• < 7.46 kΩ	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 25°C(77°F)	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"
3. Monitor the "INCAR TEMP. SENSOR" Parameter on the Scantool.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	13.0 °C
<b>IN-CAR TEMP. SENSOR</b>	<b>25.0 °C</b>
AMBIENT AIR TEMP. SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POSENTIO. (DR.)	75.68 %
DIRECTION POTENIO. DR.	89.79 %
PASSENGER PHOTO SENSOR	255
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1233 IN-CAR TEMP. SNSR LOW</b>	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B1233.

## 4. Are the DTC B1233 present and is parameter of "INCAR TEMP. SENSOR" fixed?

Parameter of "INCAR TEMP. SENSOR" will be fixed at 25°C(77°F), if there is any fault in INCAR TEMP. SENSOR.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
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HEATER WATER TEMP. SNSR	13.0 °C
<b>IN-CAR TEMP. SENSOR</b>	<b>25.0 °C</b>
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AIR MIX POPENIO. (DR.)	75.68 %
DIRECTION POTENIO. DR.	89.79 %
PASSENGER PHOTO SENSOR	255

**Fig. 1**

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1233.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1233 IN-CAR TEMP. SNSR LOW</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

## 4. Are the DTC B1233 present and is parameter of "INCAR TEMP. SENSOR" fixed?

Parameter of "INCAR TEMP. SENSOR" will be fixed at 25°C(77°F), if there is any fault in INCAR TEMP. SENSOR.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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HEATER WATER TEMP. SNSR	13.0 °C
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Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1233 IN-CAR TEMP. SNSR LOW</b>	
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
HELP	

Fig. 2

Fig 2 : DTC B1233.

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**YES**

Go to "Inspection" procedure.

**NO**

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## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

## 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## 3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

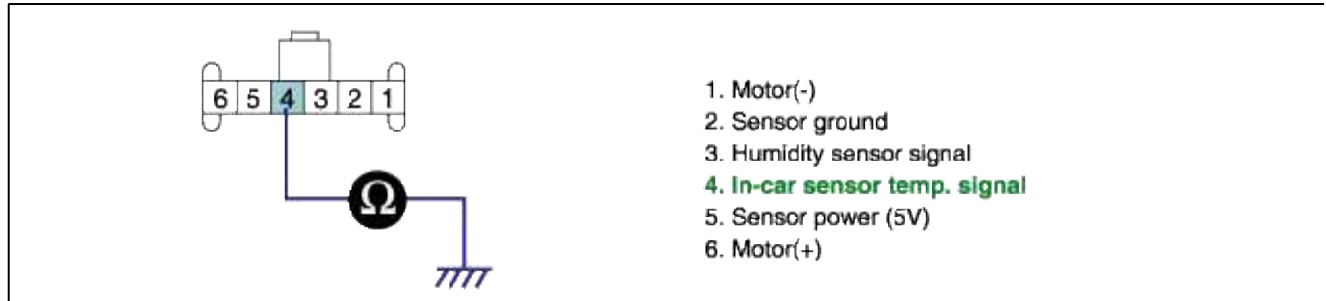
## SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect incar sensor.
  - (3) Measure resistance between terminal "4" of incar sensor and chassis ground.

---

Specification : Approx.  $\infty\Omega$

---



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
 Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
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Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

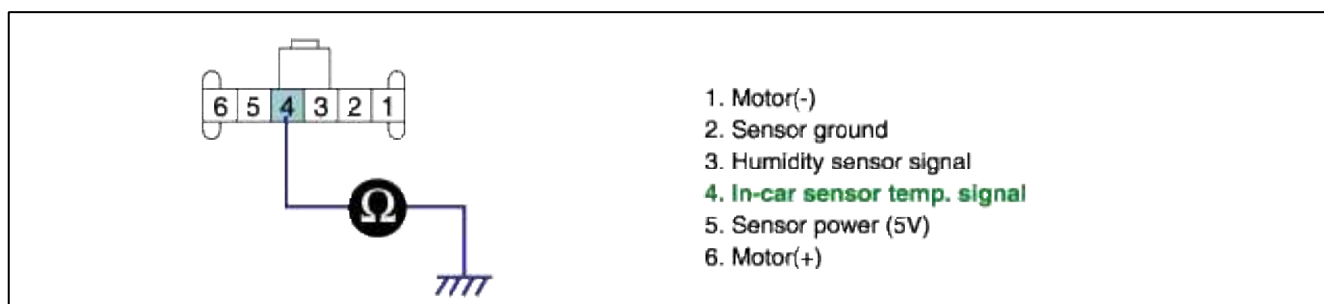
#### SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.
  - (1) Ignition "OFF"
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  - (3) Measure resistance between terminal "4" of incar sensor and chassis ground.

---

Specification : Approx.  $\infty\Omega$

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(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

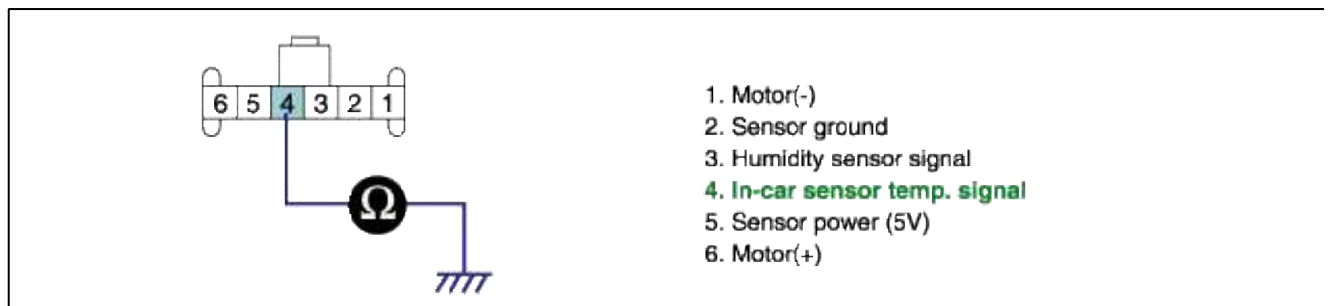
1. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect in-car sensor.

(3) Measure resistance between terminal "4" of in-car sensor and chassis ground.

Specification : Approx.  $\infty\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

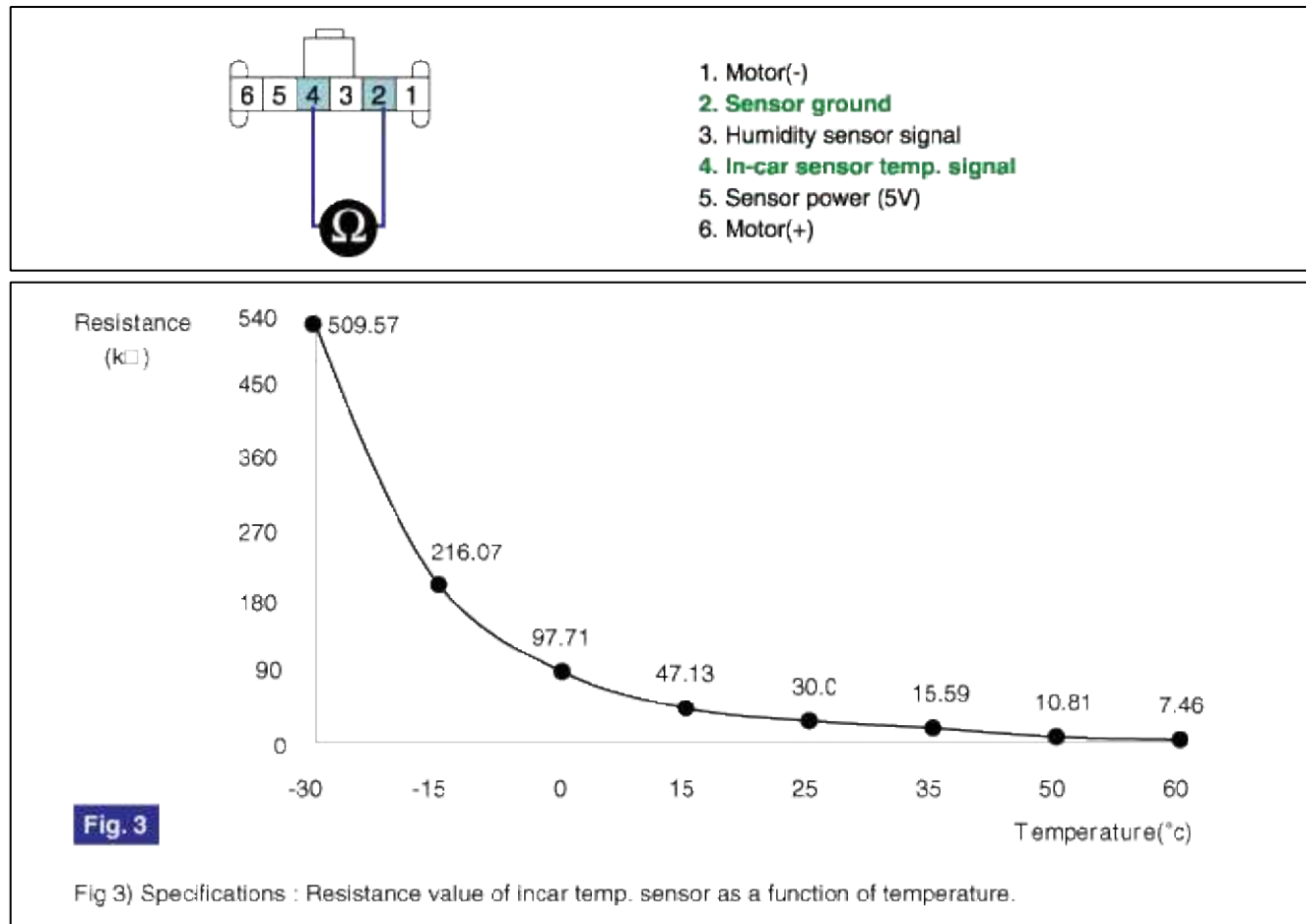
Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION



1. Check incar temp. sensor.
  - (1) Ignition "OFF"
  - (2) Disconnect incar sensor.
  - (3) Measure resistance between terminal "4" and "2" of incar sensor.

Specification : Refer the specifications in fig 3.



- (4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

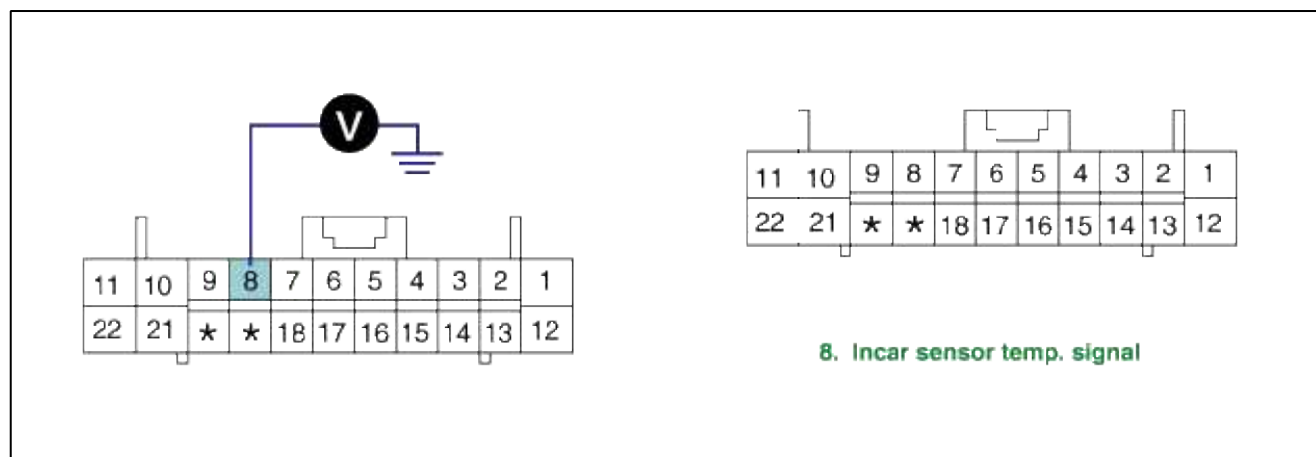
Substitute with a known-good incar sensor and check for proper operation.

If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect incar sensor.
- (3) Measure Voltage between terminal "8" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

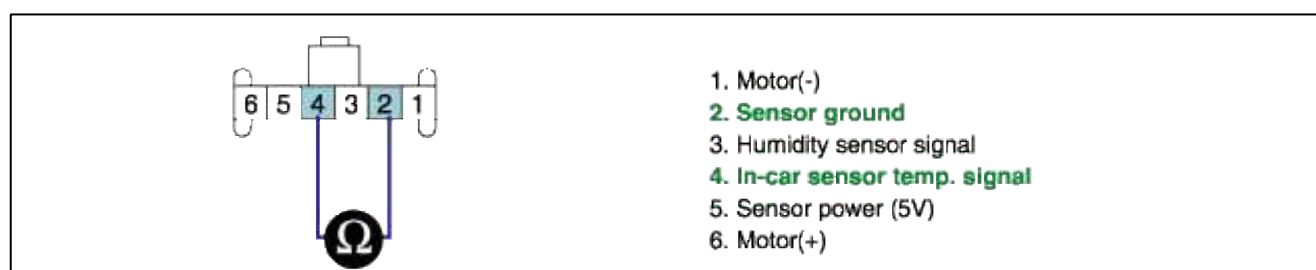
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check incar temp. sensor.

- (1) Ignition "OFF"
- (2) Disconnect incar sensor.
- (3) Measure resistance between terminal "4" and "2" of incar sensor.

Specification : Refer the specifications in fig 3.



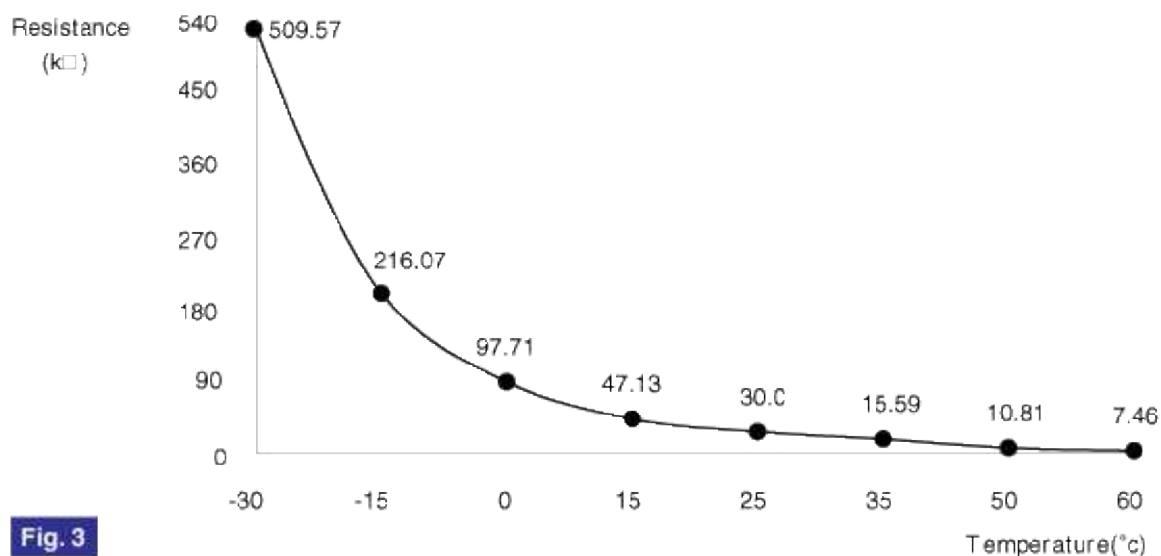
**Fig. 3**

Fig 3) Specifications : Resistance value of incar temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good incar sensor and check for proper operation.

If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

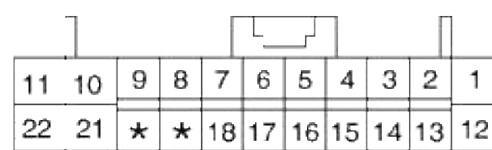
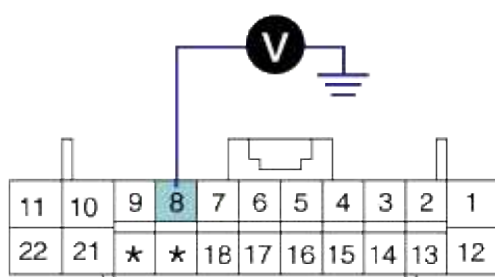
## 2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect incar sensor.

(3) Measure Voltage between terminal "8" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



**8. Incar sensor temp. signal**

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

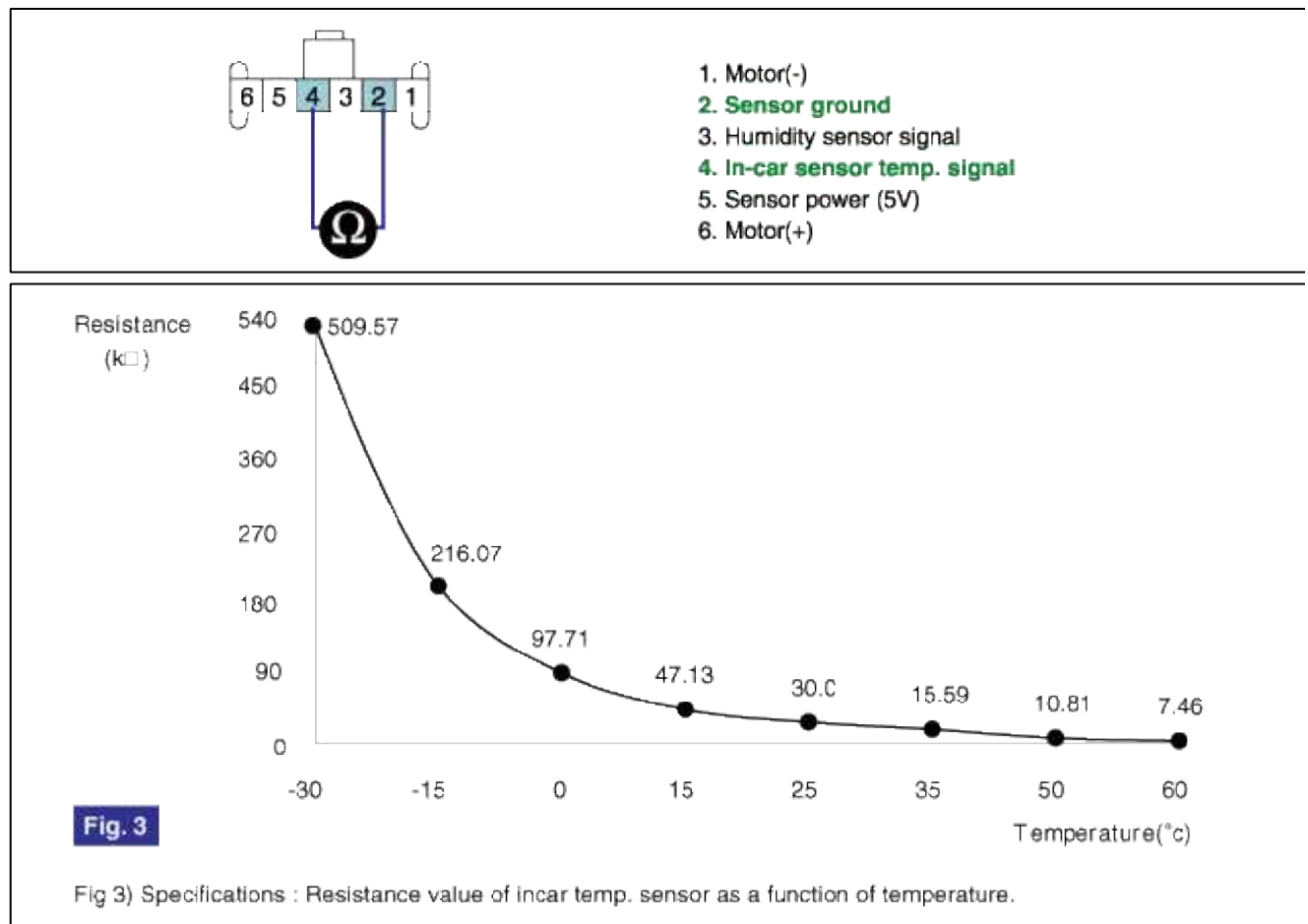
## 1. Check incar temp. sensor.

(1) Ignition "OFF"

(2) Disconnect incar sensor.

(3) Measure resistance between terminal "4" and "2" of incar sensor.

Specification : Refer the specifications in fig 3.

(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

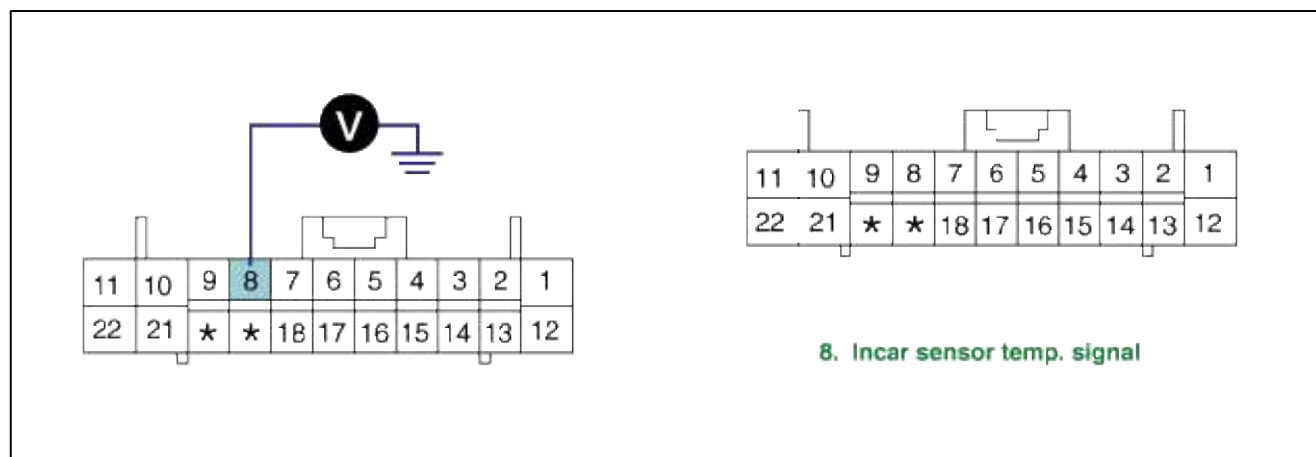
Substitute with a known-good incar sensor and check for proper operation.

If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect incar sensor.
- (3) Measure Voltage between terminal "8" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



## (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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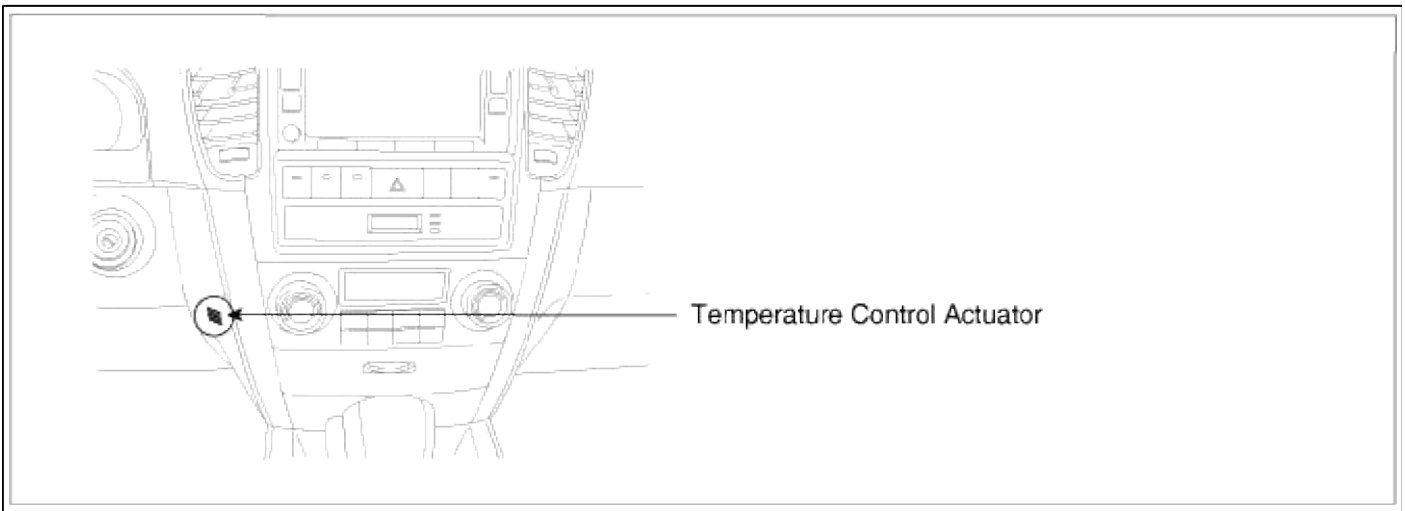
Go to the applicable troubleshooting procedure.

**NO**

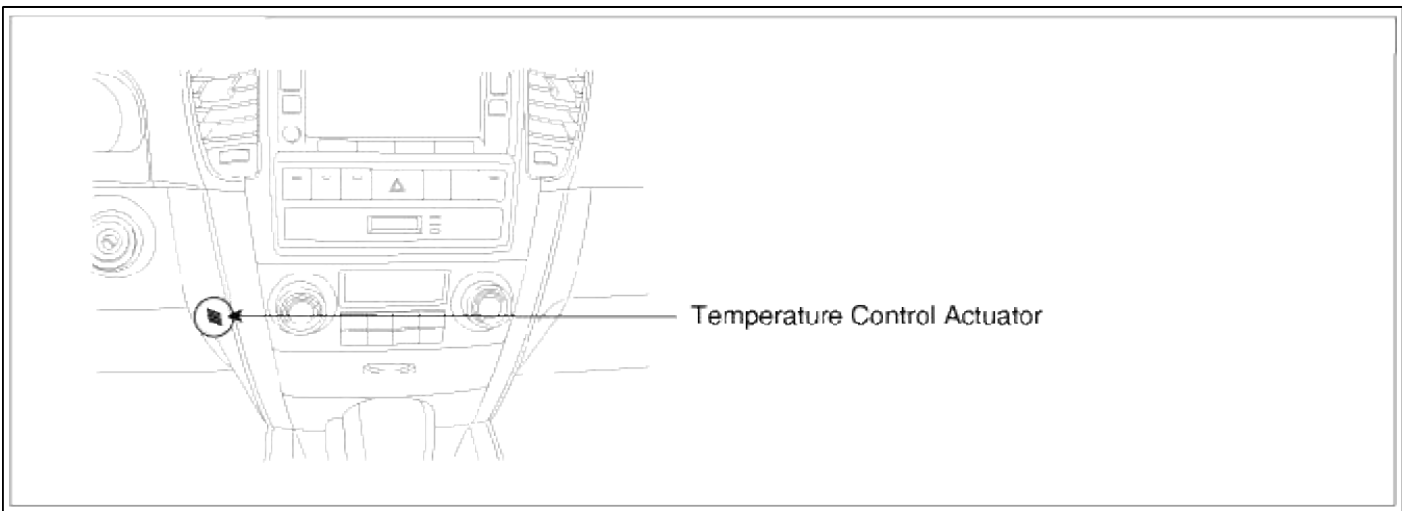
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1234

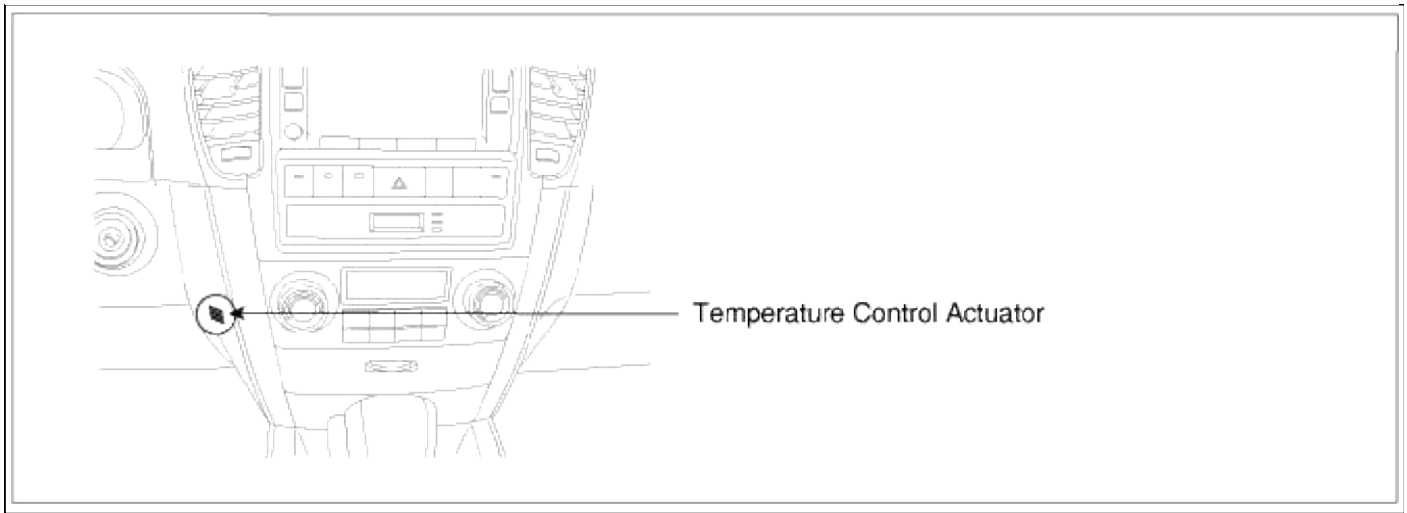
#### COMPONENT LOCATION



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#### GENERAL DESCRIPTION

The incar temperature sensor located at crush pad, control unit contains a thermistor which measures the temperature of the inside. The signal, decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal, the control unit regulates incar temperature to intended value.

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#### DTC DESCRIPTION

The A/C controller sets DTC B1234 if there is an open circuit in incar temp. sensor signal harness or the measured resistance value of sensor is more than threshold value(about 509.57k $\Omega$ )

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Open Circuit in harness</li> <li>• Faulty incar temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• > 509.57 kΩ	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 25°C(77°F)	

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Threshold value	• > 509.57 kΩ	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 25°C(77°F)	

## MONITOR SCANTOOL DATA

1. Connect scantool to data link connector(DLC).
2. Engine "ON"



## 3. Monitor the "INCAR TEMP. SENSOR" Parameter on the Scantool.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	13.0 °C
<b>IN-CAR TEMP. SENSOR</b>	<b>25.0 °C</b>
AMBIENT AIR TEMP. SNS	11.5 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POSENTIO. (DR.)	75.68 %
DIRECTION POTENIO. DR.	89.79 %
PASSENGER PHOTO SENSOR	255
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1234 IN-CAR TEMP. SNSR HIGH</b>	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B1234.

## 4. Are the DTC B1234 present and is parameter of "INCAR TEMP. SENSOR" fixed?

Parameter of "INCAR TEMP. SENSOR" will be fixed at 25°C(77°F), if there is any fault in INCAR TEMP. SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.

(1) Ignition "OFF"

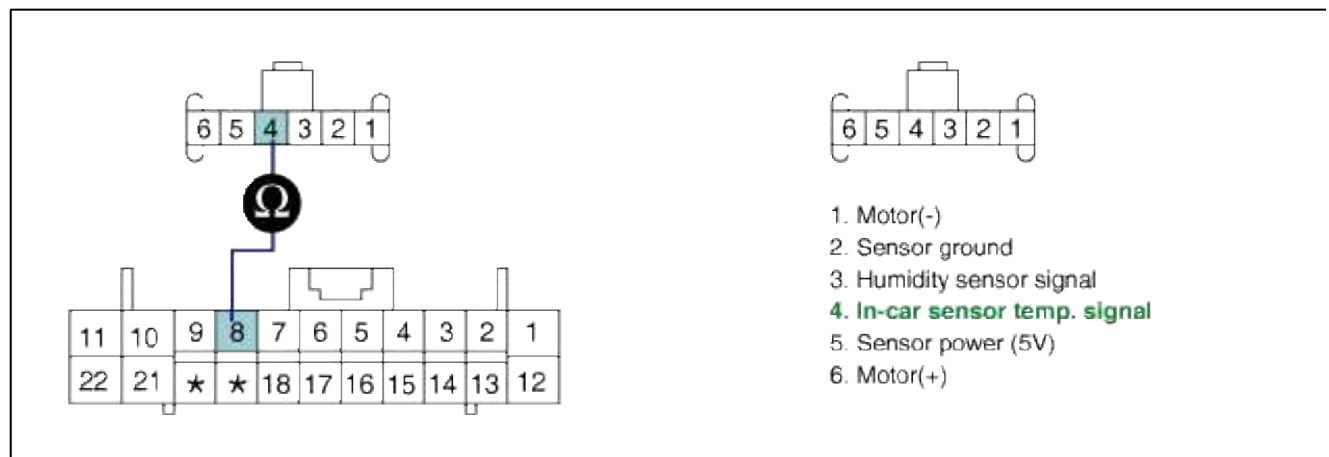
(2) Disconnect incar temp. sensor.

(3) Measure resistance between terminal "4" of incar temp. sensor and terminal "8" of A/C Control Unit..

---

Specification : Approx. 0  $\Omega$

---



(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### GROUND CIRCUIT INSPECTION

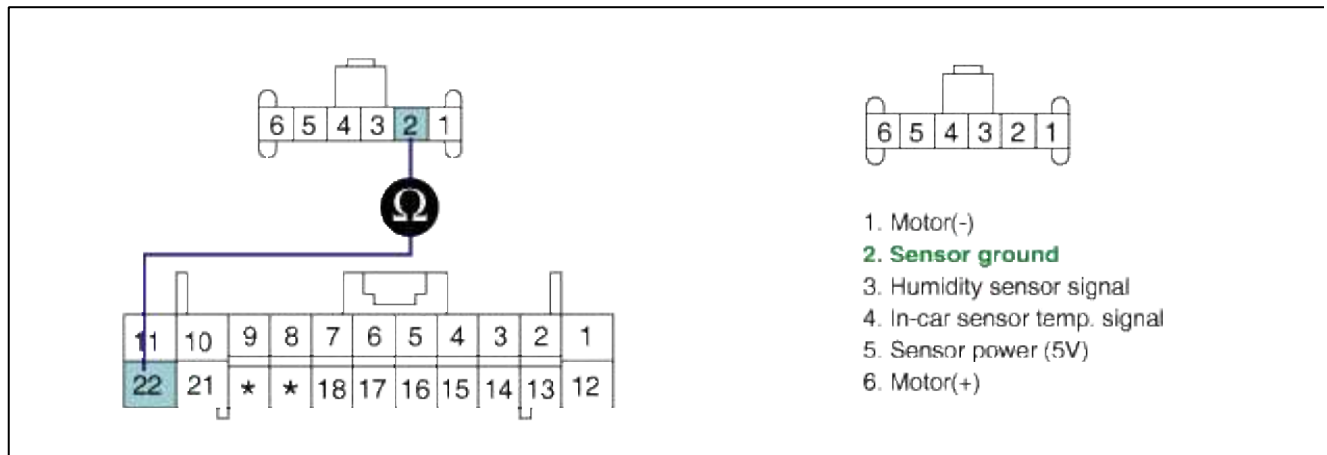
1. Check for open in ground harness.

(1) Ignition "OFF"

(2) Disconnect incar temp. sensor.

(3) Measure resistance between terminal "2" of incar temp. sensor and terminal "22" of A/C Control Unit.

Specification : Approx.  $0\ \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

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**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

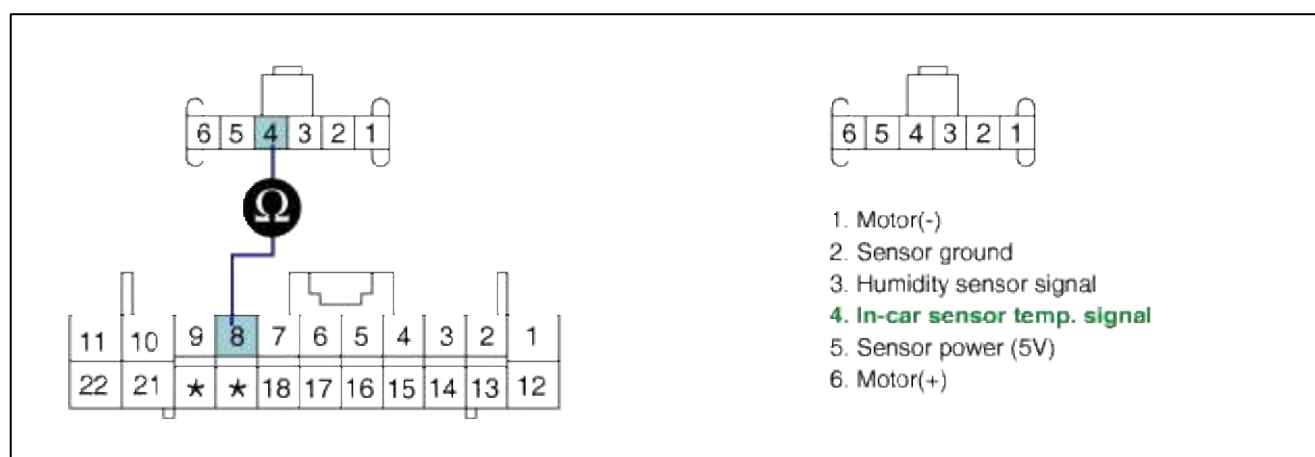
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect in-car temp. sensor.

(3) Measure resistance between terminal "4" of incar temp. sensor and terminal "8" of A/C Control Unit..

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

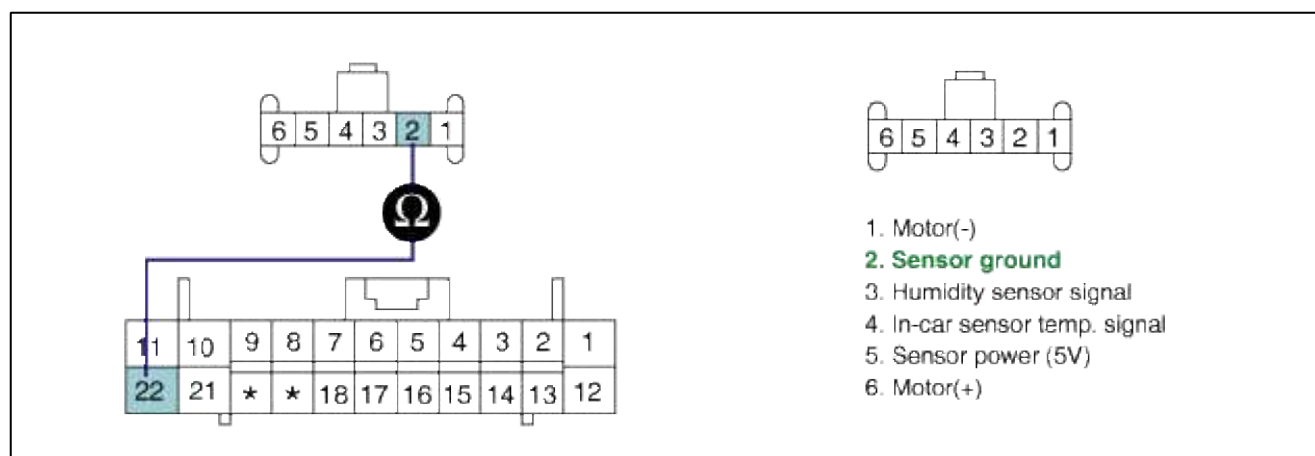
1. Check for open in ground harness.

(1) Ignition "OFF"

(2) Disconnect incar temp. sensor.

(3) Measure resistance between terminal "2" of incar temp. sensor and terminal "22" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

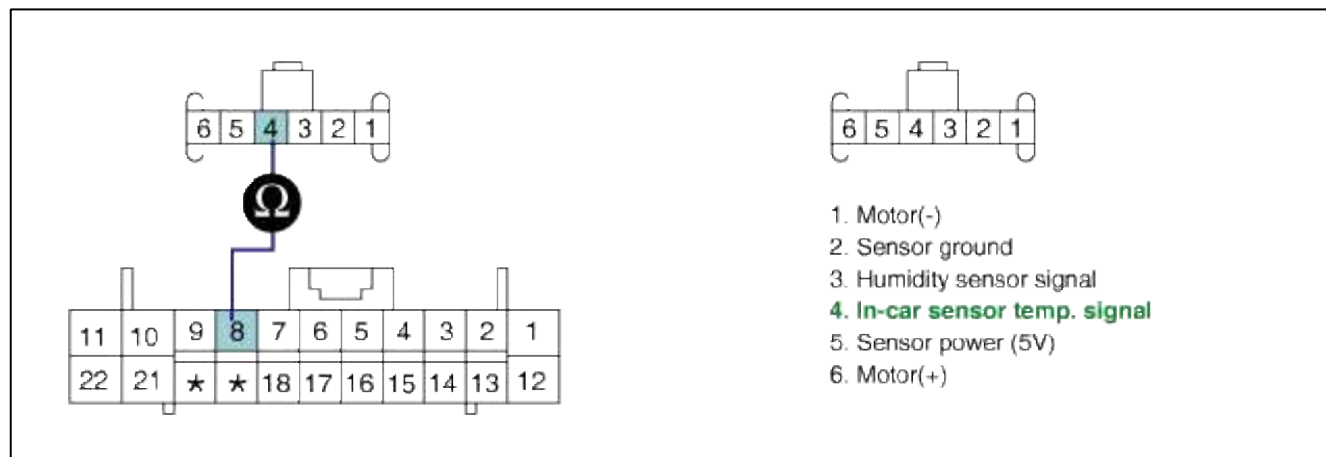
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

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  - (2) Disconnect incar temp. sensor.
  - (3) Measure resistance between terminal "4" of incar temp. sensor and terminal "8" of A/C Control Unit..

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

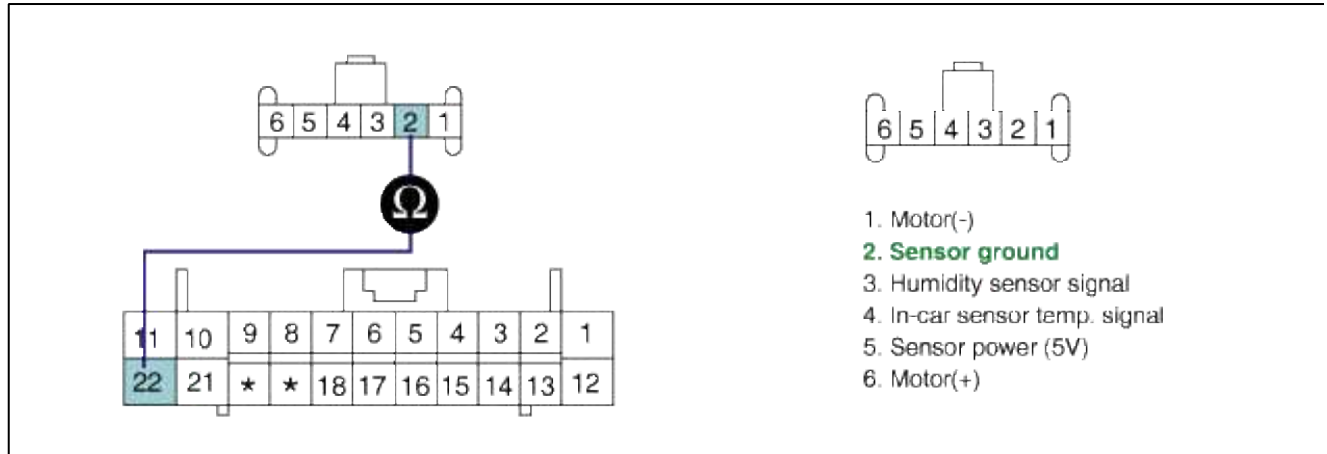
**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### GROUND CIRCUIT INSPECTION

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Go to "Component Inspection" procedure.

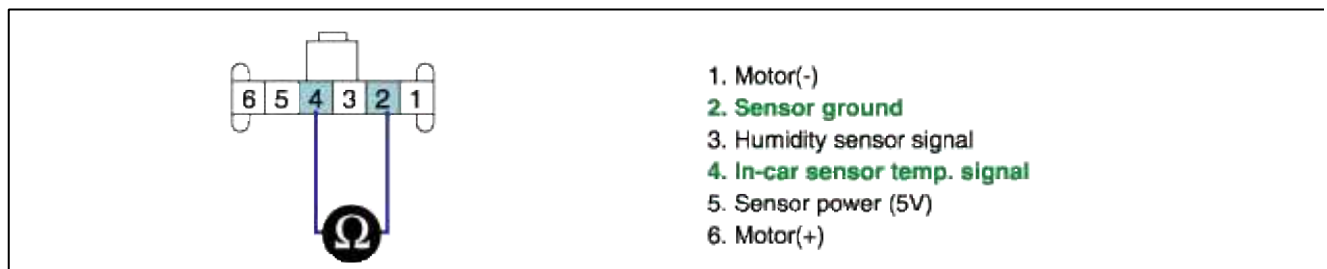
**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Check incar temp. sensor.
  - (1) Ignition "OFF"
  - (2) Disconnect incar sensor.
  - (3) Measure resistance between terminal "4" and "2" of incar sensor.

Specification : Refer the specifications in fig 3.



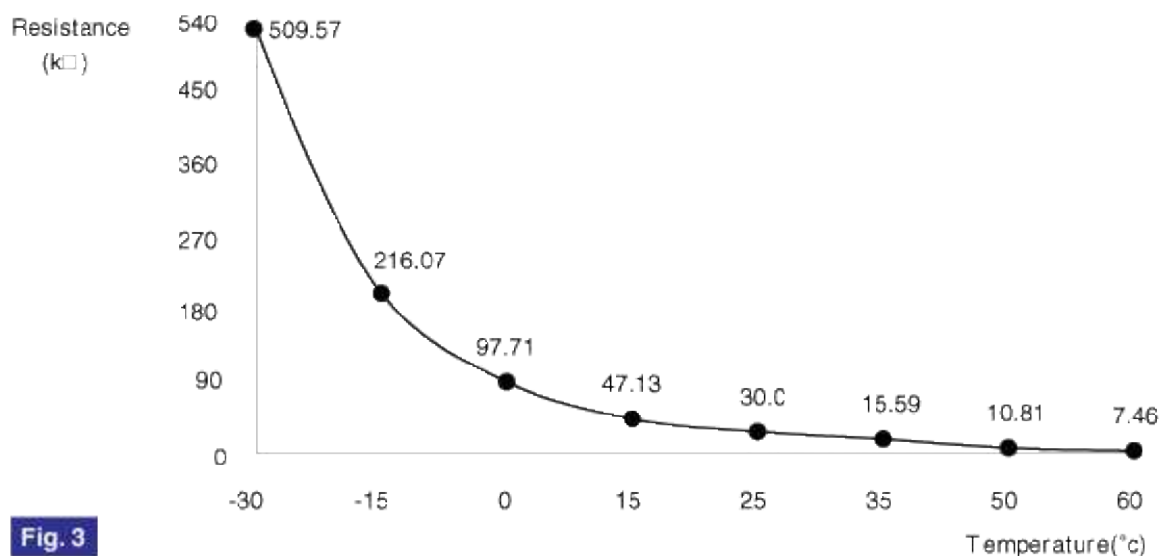


Fig. 3

Fig 3) Specifications : Resistance value of incar temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good incar sensor and check for proper operation.

If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

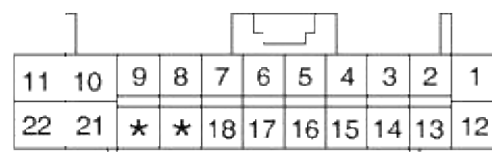
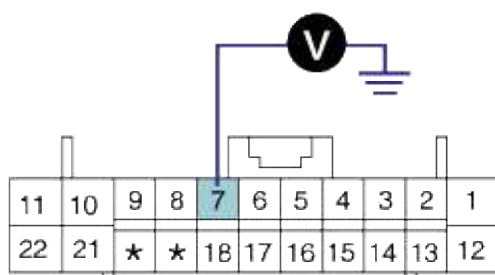
## 2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect incar sensor.

(3) Measure Voltage between terminal "7" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



7. Incar sensor temp. signal

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

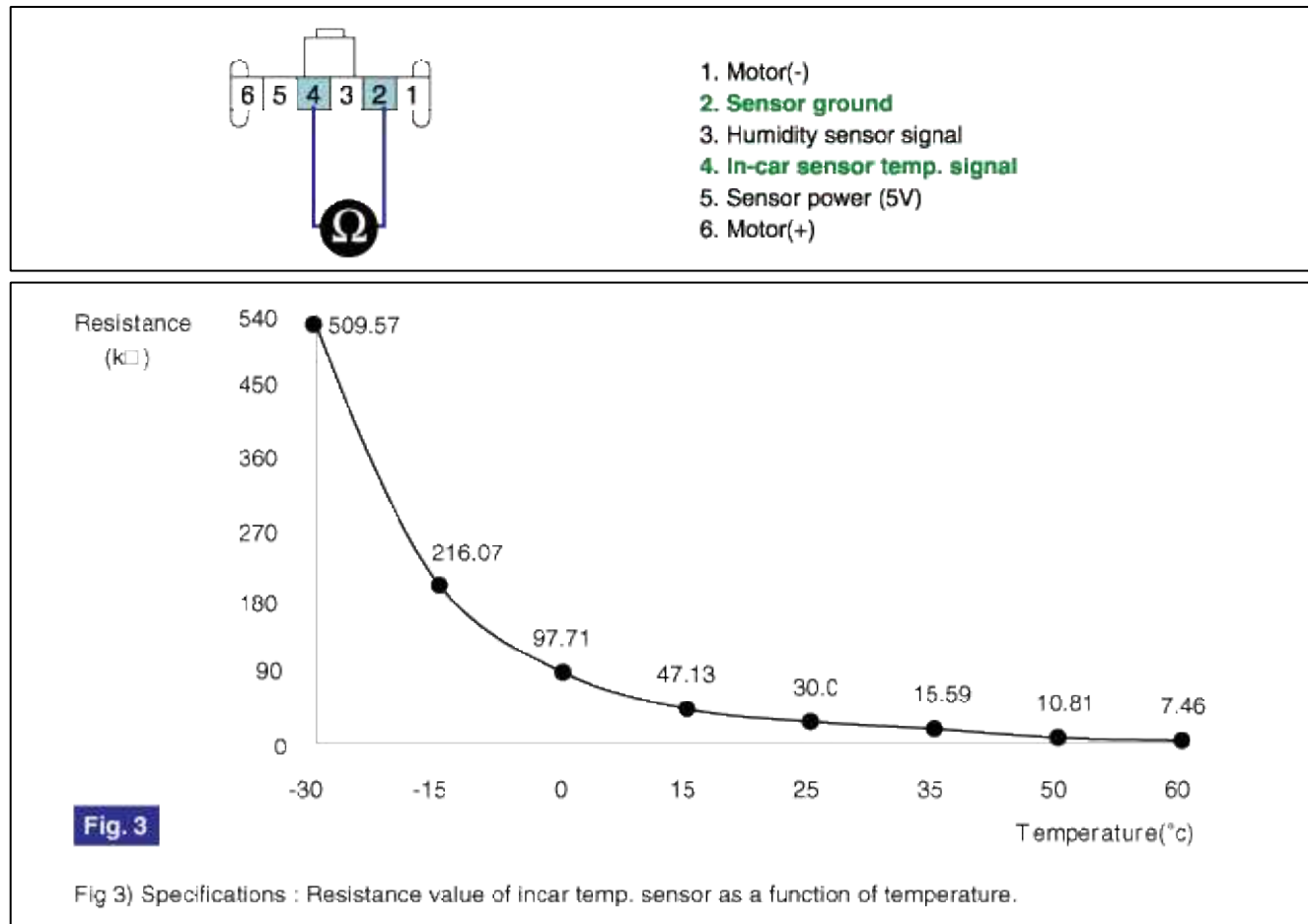


## COMPONENT INSPECTION

## 1. Check incar temp. sensor.

- (1) Ignition "OFF"
- (2) Disconnect incar sensor.
- (3) Measure resistance between terminal "4" and "2" of incar sensor.

Specification : Refer the specifications in fig 3.



- (4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

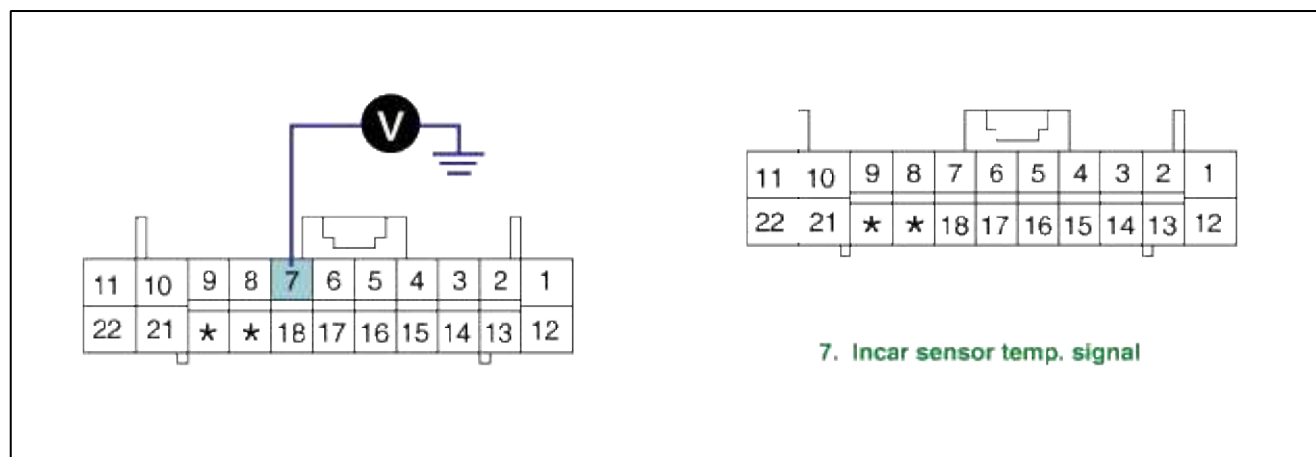
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If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect incar sensor.
- (3) Measure Voltage between terminal "7" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

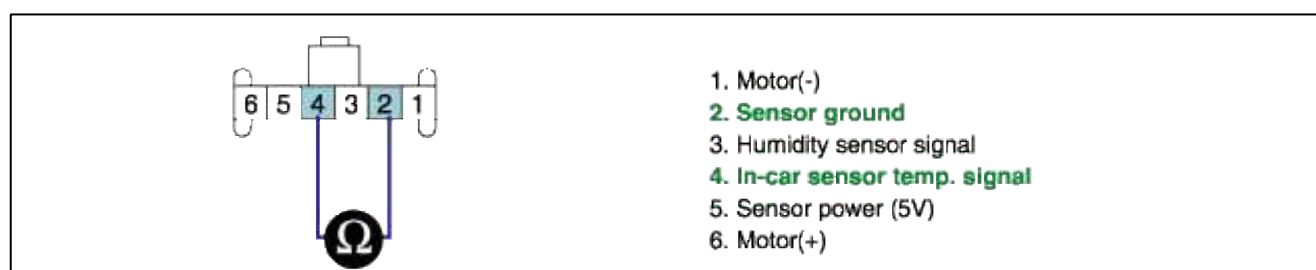
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

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- (3) Measure resistance between terminal "4" and "2" of incar sensor.

Specification : Refer the specifications in fig 3.



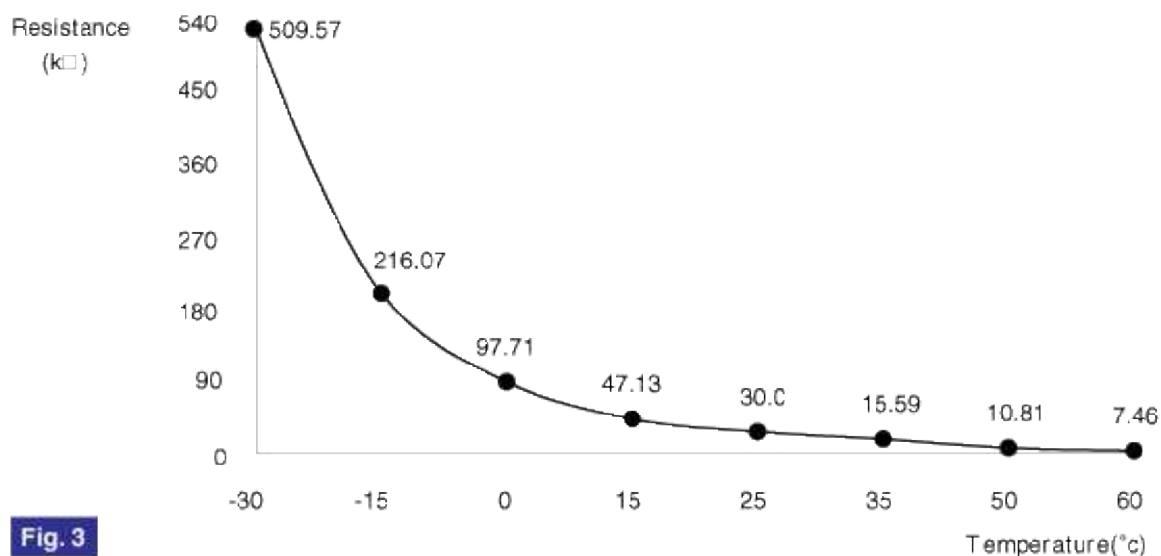


Fig. 3

Fig 3) Specifications : Resistance value of incar temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good incar sensor and check for proper operation.

If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

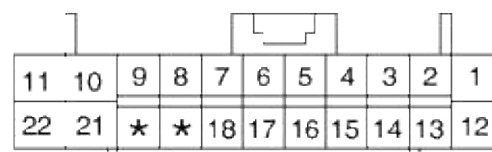
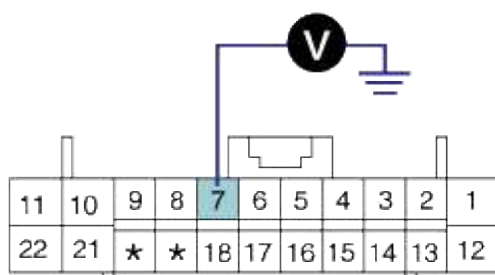
## 2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect incar sensor.

(3) Measure Voltage between terminal "7" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



7. Incar sensor temp. signal

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

**VERIFICATION OF VEHICLE REPAIR**

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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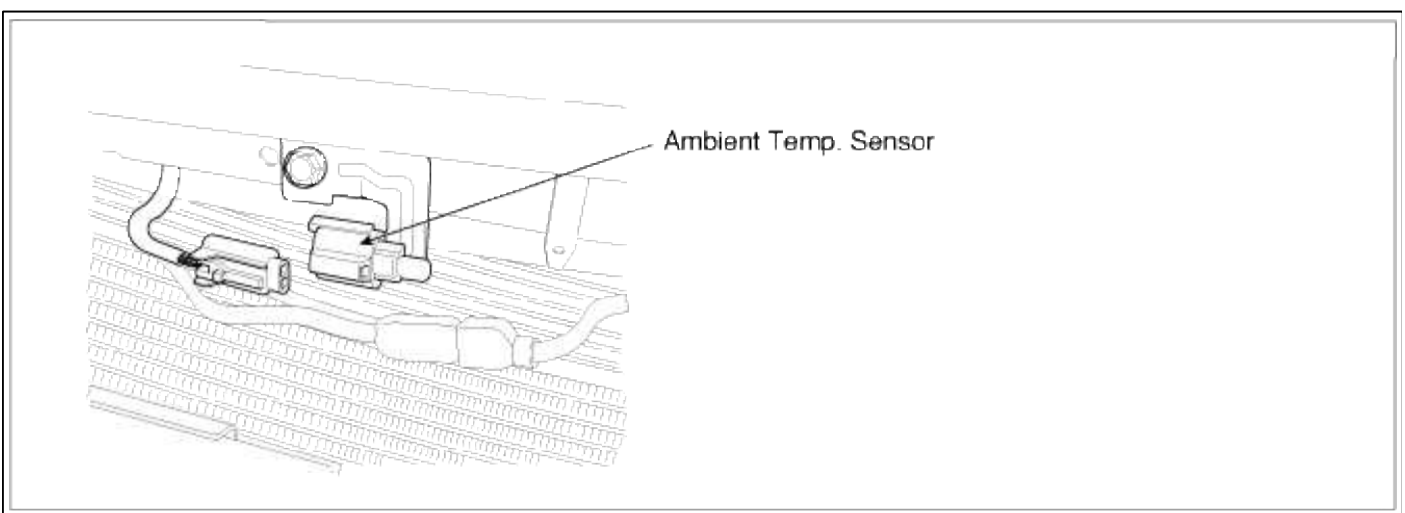
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2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

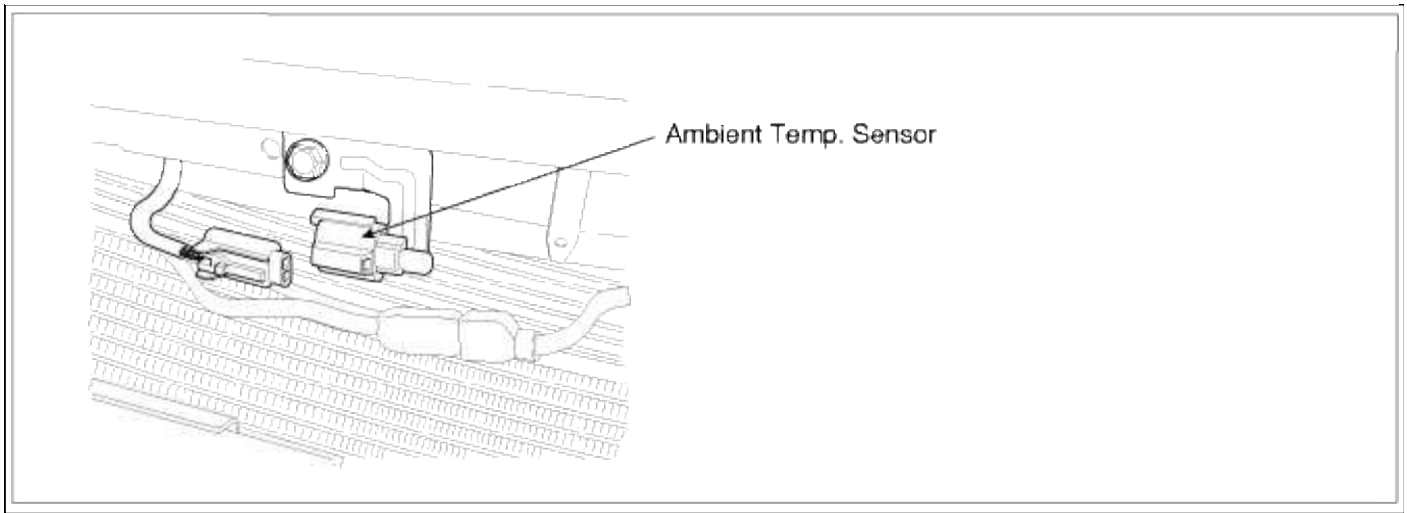
**YES**

Go to the applicable troubleshooting procedure.

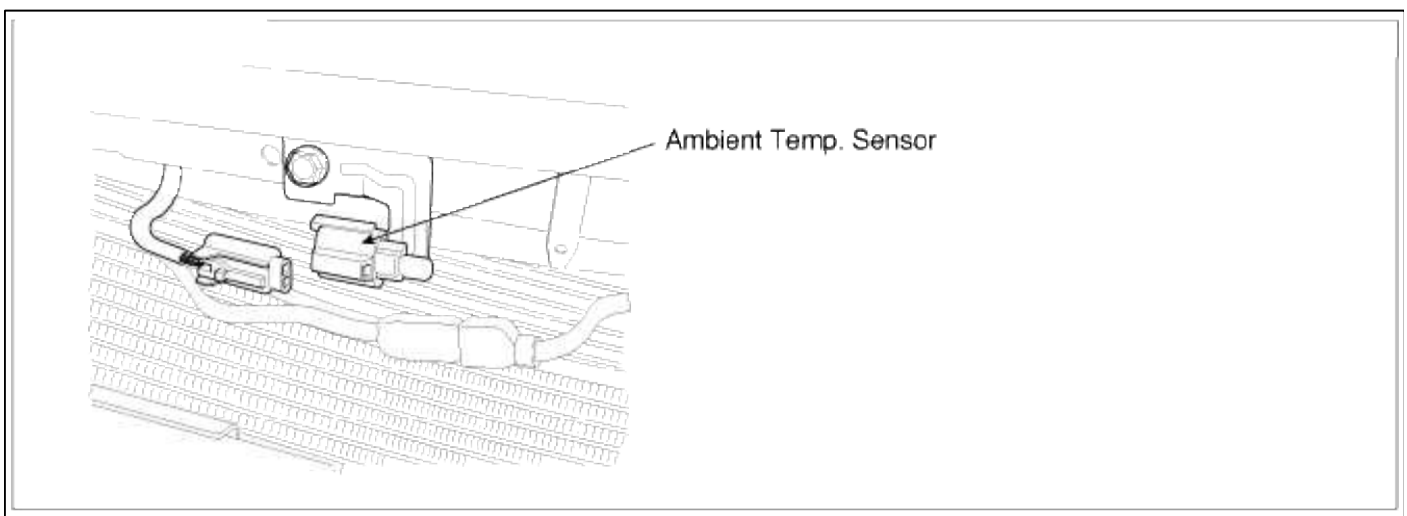
**NO**

System is performing to specification at this time.

**Heating,Ventilation, Air Conditioning > Troubleshooting > B1237**
**COMPONENT LOCATION****COMPONENT LOCATION**



## COMPONENT LOCATION



## GENERAL DESCRIPTION

The ambient temperature sensor located at the center stay of the condenser, detects ambient air temperature. It is a negative type thermistor whose resistance is inversely proportional to temperature. Its output is used for discharge temperature sensor, sensor fail-safe, temperature regulation door lock, blower motor level control, mix mode control and in-car humidity control.

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## DTC DESCRIPTION

The A/C controller sets DTC B1237 if there is a short circuit in ambient temp. sensor signal harness or the measured resistance value of sensor is less than threshold value(about 7.48k $\Omega$ )

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**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty ambient temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• < 7.48k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 20°C(68°F)	

**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty ambient temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
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DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty ambient temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• < 7.48k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 20°C(68°F)	

**MONITOR SCANTOOL DATA**

1. Connect scantool to data link connector(DLC).
2. Engine "ON"

## 3. Monitor the "AMBIENT TEMP. SENSOR" Parameter on the Scantool.

Parameter of "AMBIENT TEMP. SENSOR" will be fixed at 20°C, if there is any fault in AMBIENT TEMP. SENSOR.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	17.0 °C
IN-CAR TEMP. SENSOR	12.0 °C
<b>AMBIENT AIR TEMP. SNS</b>	<b>20.0 °C</b>
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	90.18 %
PASSENGER PHOTO SENSOR	255
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1237 AMBIENT TEMP. SNSR LOW</b>	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B1237.

## 4. Are the DTC B1237 present and is parameter of "AMBIENT TEMP. SENSOR" fixed?

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

## 1. Connect scantool to data link connector(DLC).

## 2. Engine "ON"

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**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1237 AMBIENT TEMP. SNSR LOW</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

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## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.



## SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.

(1) Ignition "OFF"

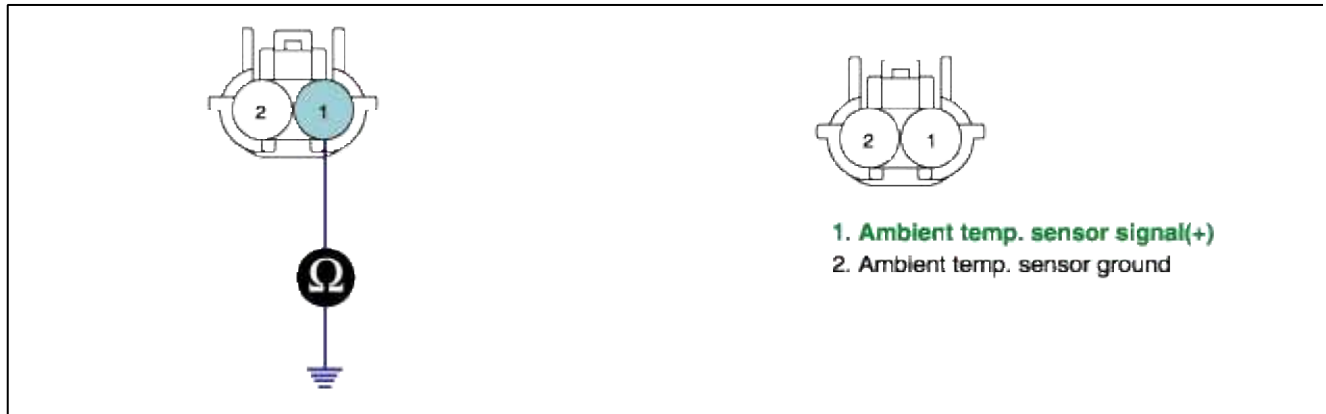
(2) Disconnect ambient temp. sensor.

(3) Measure resistance between terminal "1" of ambient temp. sensor and chassis ground.

---

Specification : Approx.  $\infty\Omega$

---



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

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**NO**

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Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

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1. Check for short to ground in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect ambient temp. sensor.
  - (3) Measure resistance between terminal "1" of ambient temp. sensor and chassis ground.

---

Specification : Approx.  $\infty\Omega$

---



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

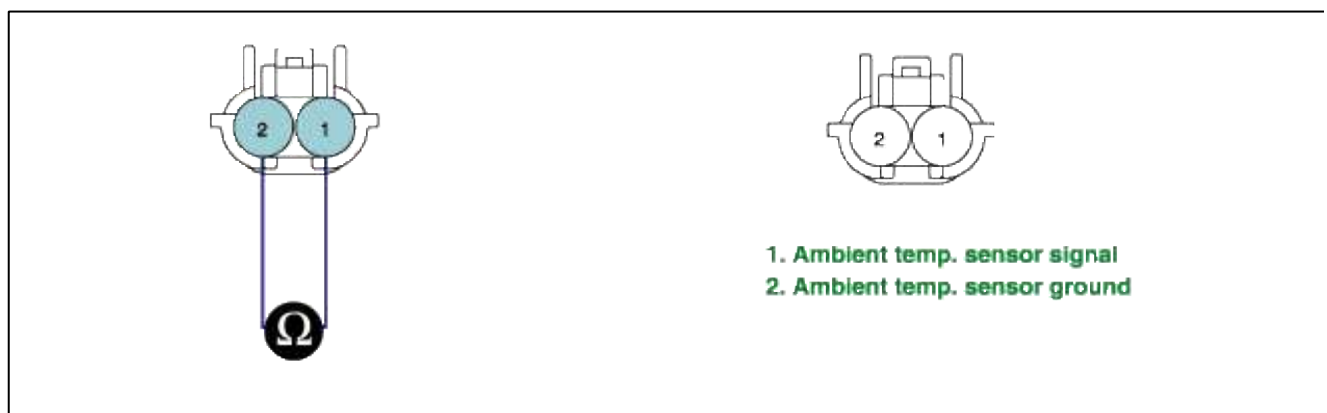
## COMPONENT INSPECTION

1. Check Ambient temp. sensor.
  - (1) Ignition "OFF"
  - (2) Disconnect ambient temp. sensor.
  - (3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.

---

Specification : Refer the specifications in fig 3.

---



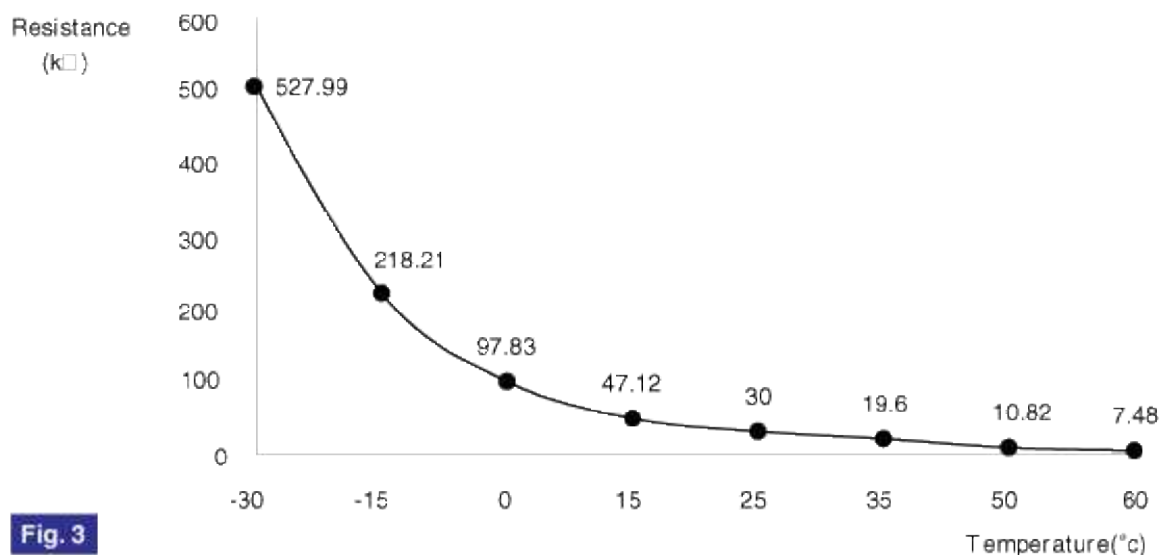


Fig 3) Specifications : Resistance value of ambient temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good ambient temp. sensor and check for proper operation.

If the problem is corrected, replace ambient temp. sensor and then go to "Verification of Vehicle Repair" procedure.

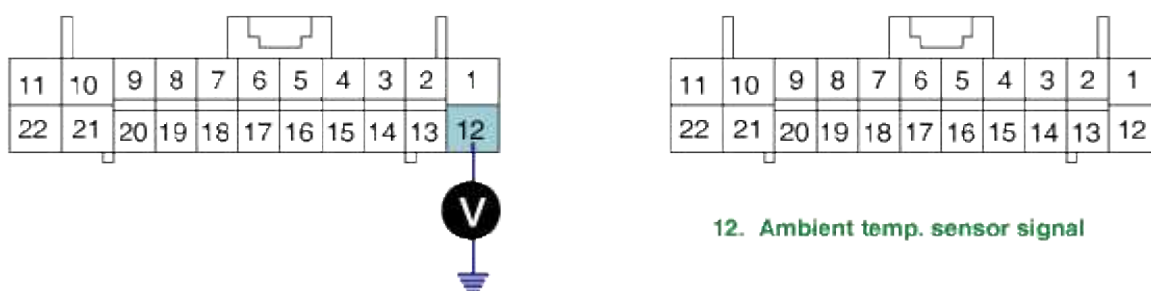
## 2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect ambient temp. sensor.

(3) Measure voltage between terminal "12" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

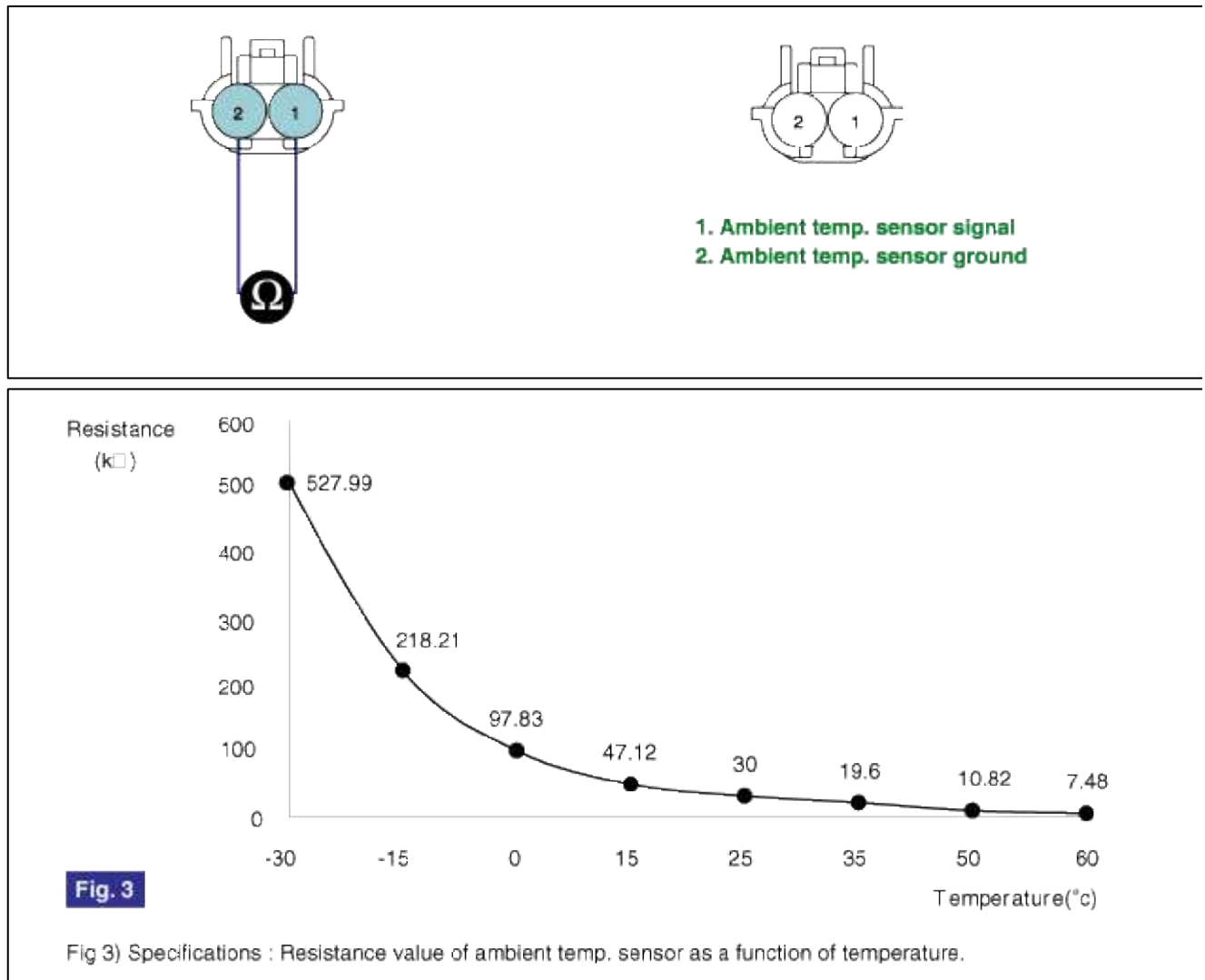
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check Ambient temp. sensor.

- (1) Ignition "OFF"
- (2) Disconnect ambient temp. sensor.
- (3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.

Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

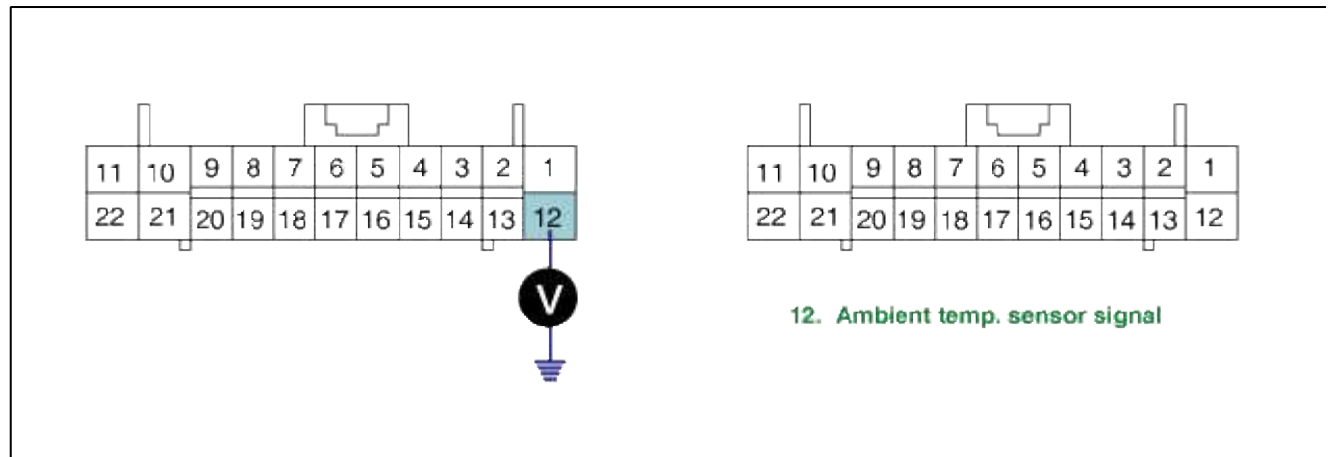
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- (3) Measure voltage between terminal "12" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



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**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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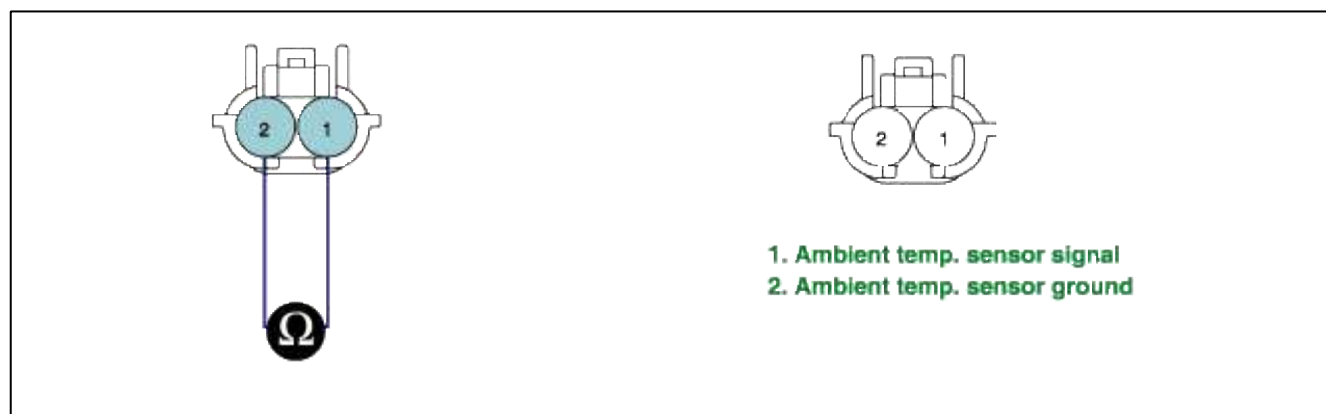
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. Check Ambient temp. sensor.

- (1) Ignition "OFF"
- (2) Disconnect ambient temp. sensor.
- (3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.

Specification : Refer the specifications in fig 3.



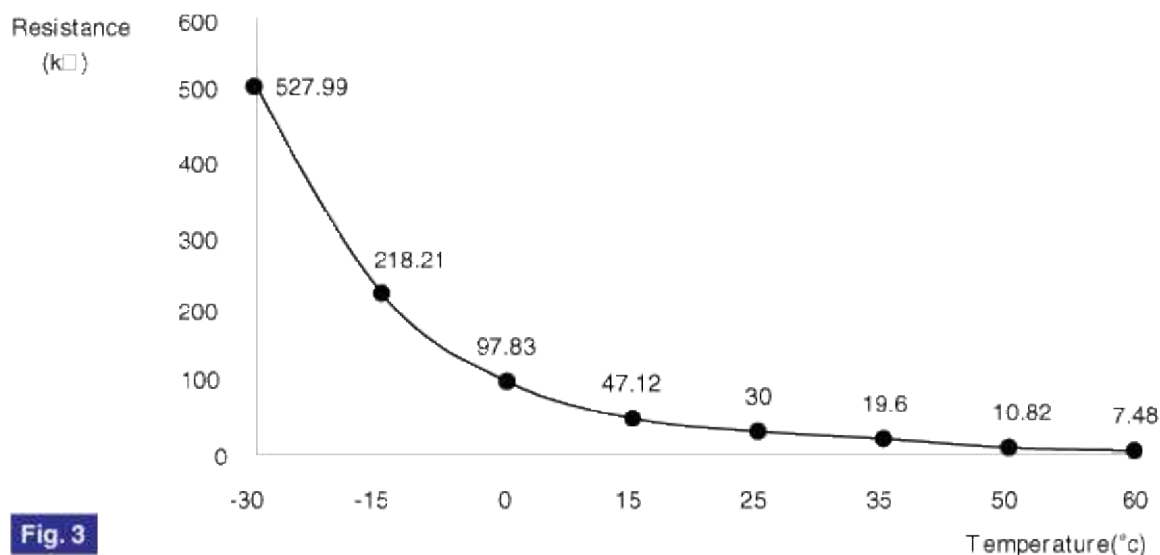


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(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

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**NO**

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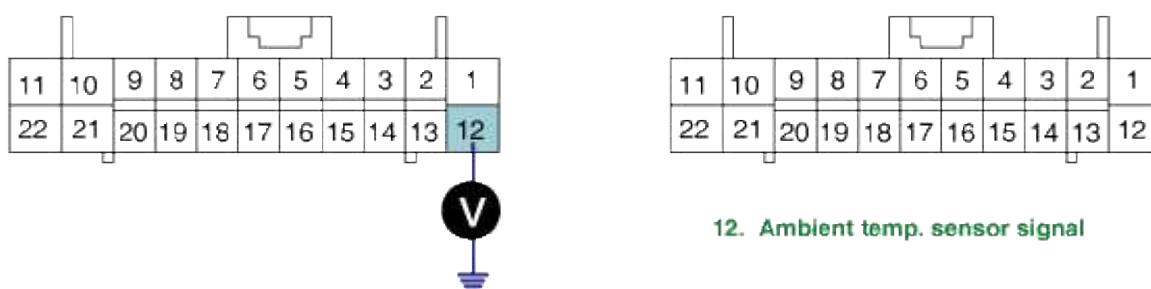
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(1) Engine "ON"

(2) Disconnect ambient temp. sensor.

(3) Measure voltage between terminal "12" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

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After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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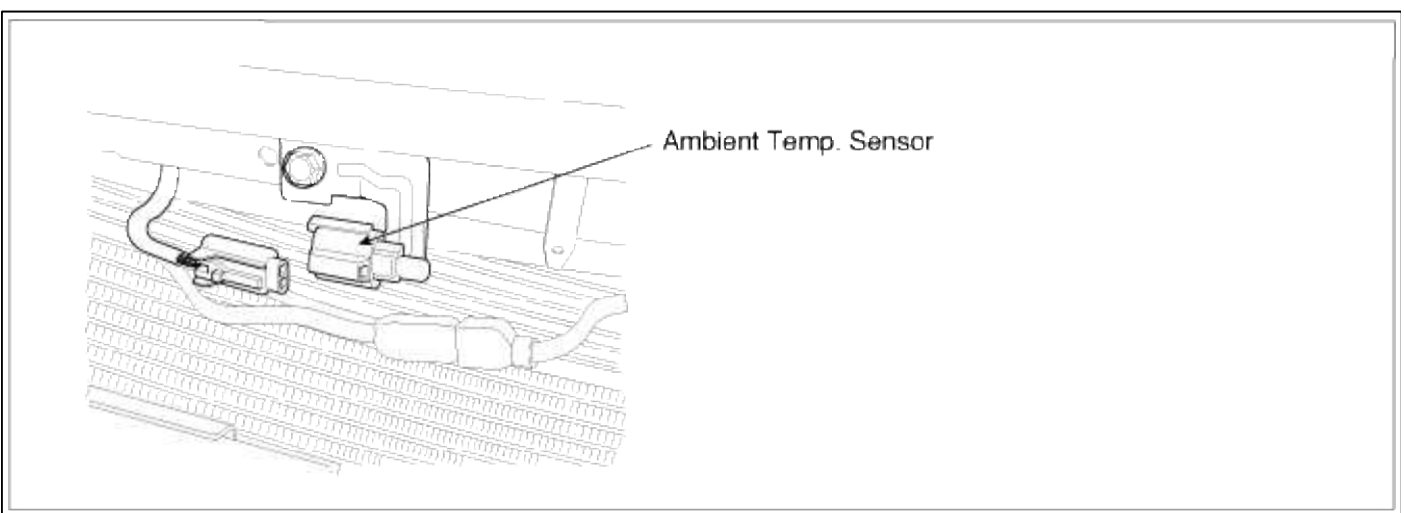
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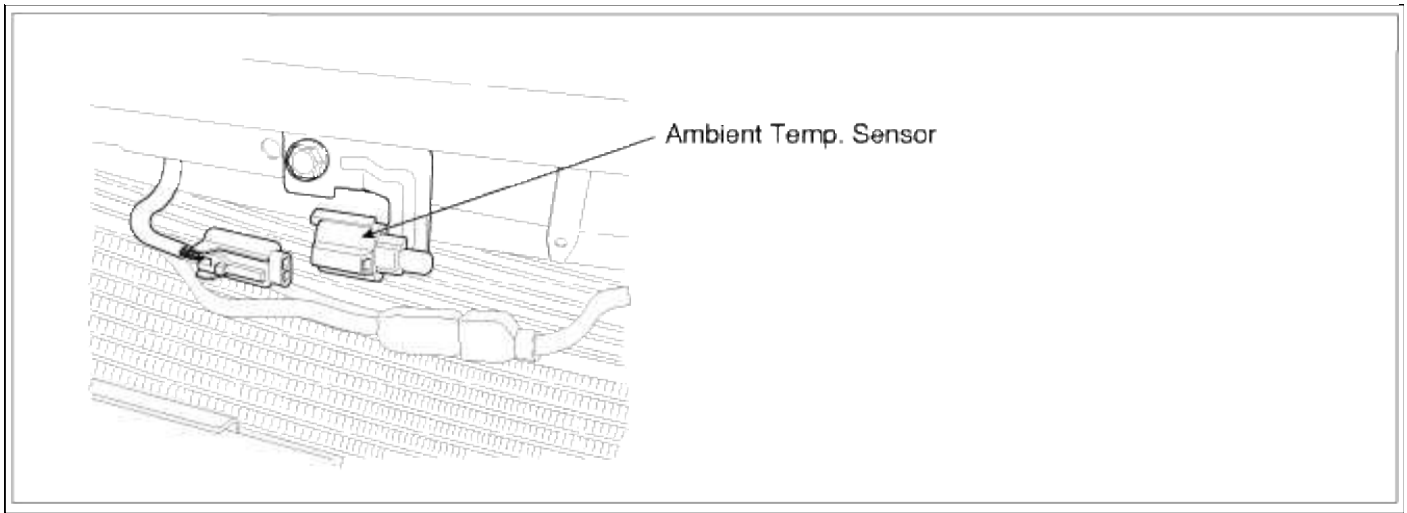
Go to the applicable troubleshooting procedure.

**NO**

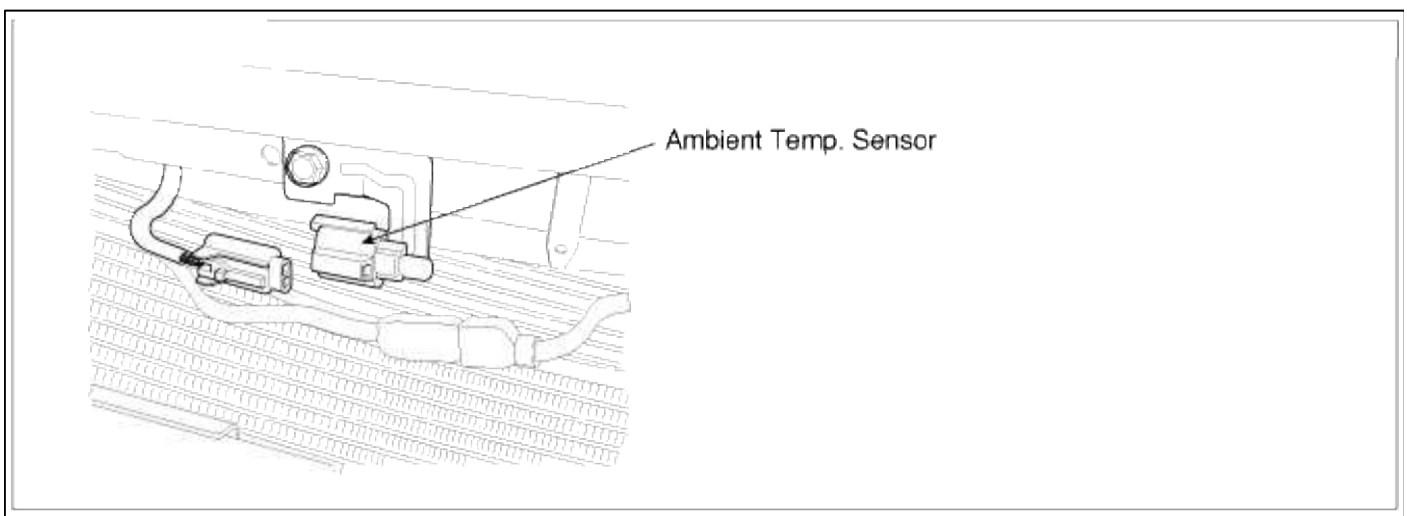
System is performing to specification at this time.

**Heating,Ventilation, Air Conditioning > Troubleshooting > B1238**
**COMPONENT LOCATION****COMPONENT LOCATION**





## COMPONENT LOCATION



## GENERAL DESCRIPTION

The ambient temperature sensor located at the center stay of the condenser, detects ambient air temperature. It is a negative type thermistor whose resistance is inversely proportional to temperature. Its output is used for discharge temperature sensor, sensor fail-safe, temperature regulation door lock, blower motor level control, mix mode control and in-car humidity control.

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**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Open Circuit in harness</li> <li>• Faulty ambient temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• > 527k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 20°C(67°F)	

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Threshold value	• > 527k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 20°C(67°F)	

**MONITOR SCANTOOL DATA**

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"

## 3. Monitor the "AMBIENT TEMP. SENSOR" Parameter on the Scantool.

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1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	17.0 °C
IN-CAR TEMP. SENSOR	12.0 °C
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Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1238 AMBIENT TEMP. SNSR HIGH</b>	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B1238.

## 4. Are the DTC B1238 present and is parameter of "AMBIENT TEMP. SENSOR" fixed?

☐ YES

Go to "Inspection" procedure.

☐ NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

## 1. Connect scantool to Data Link Connector(DLC).

## 2. Engine "ON"

## 3. Monitor the "AMBIENT TEMP. SENSOR" Parameter on the Scantool.

Parameter of "AMBIENT TEMP. SENSOR" will be fixed at 20°C(67°F), if there is any fault in AMBIENT TEMP. SENSOR.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	17.0 °C
IN-CAR TEMP. SENSOR	12.0 °C
<b>AMBIENT AIR TEMP. SNS</b>	<b>20.0 °C</b>
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPTENTIO. (DR.)	91.75 %
DIRECTION POTENTIO. DR.	90.18 %
PASSENGER PHOTO SENSOR	255
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1238 AMBIENT TEMP. SNSR HIGH</b>	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B1238.

4. Are the DTC B1238 present and is parameter of "AMBIENT TEMP. SENSOR" fixed?

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).

2. Engine "ON"

3. Monitor the "AMBIENT TEMP. SENSOR" Parameter on the Scantool.

Parameter of "AMBIENT TEMP. SENSOR" will be fixed at 20°C(67°F), if there is any fault in AMBIENT TEMP. SENSOR.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	17.0 °C
IN-CAR TEMP. SENSOR	12.0 °C
<b>AMBIENT AIR TEMP. SNS</b>	<b>20.0 °C</b>
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO. (DR.)	91.75 %
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PASSENGER PHOTO SENSOR	255

**Fig. 1**

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1238.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1238 AMBIENT TEMP. SNSR HIGH</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

4. Are the DTC B1238 present and is parameter of "AMBIENT TEMP. SENSOR" fixed?

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

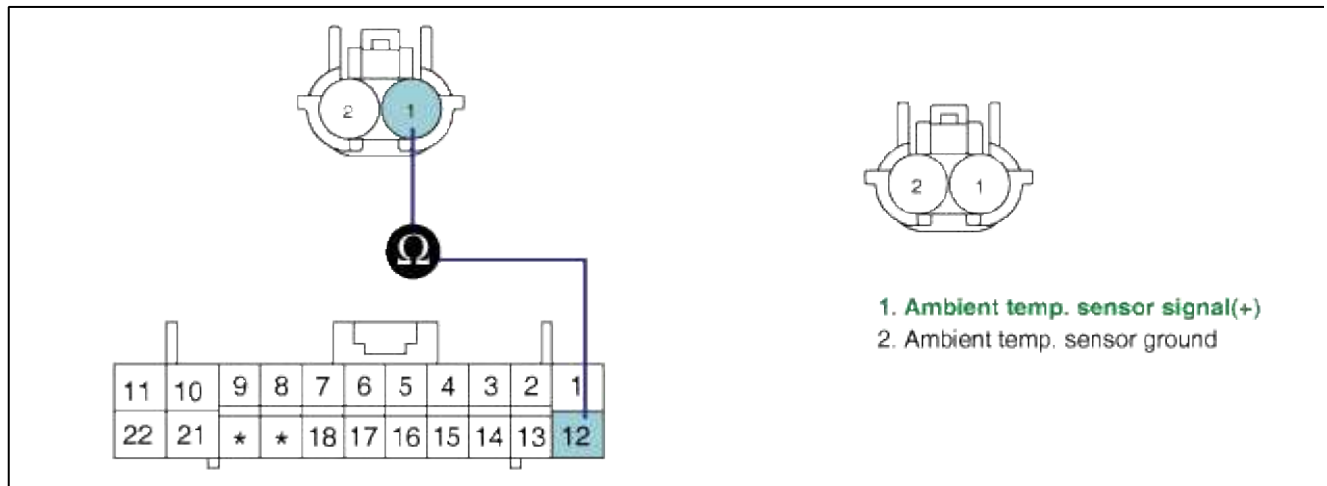
Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

### 1. Check for open in harness.

- (1) Ignition "OFF"
- (2) Disconnect ambient temp. sensor.
- (3) Measure resistance between terminal "1" of ambient temp. sensor and terminal "12" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



### (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

**NO**

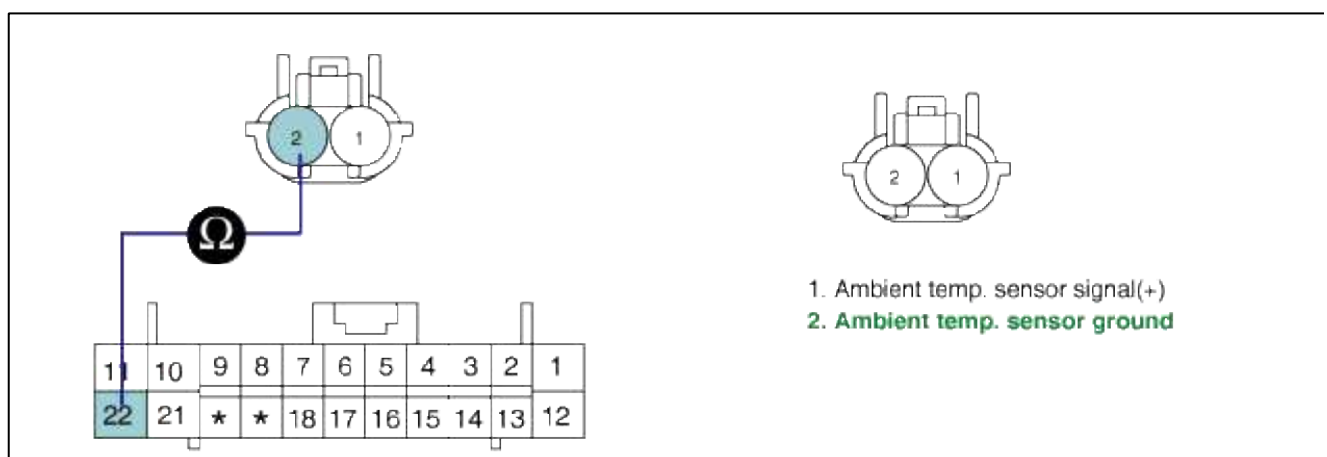
Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

### 1. Check for open in ground harness.

- (1) Ignition "OFF"
- (2) Disconnect ambient temp. sensor.
- (3) Measure resistance between terminal "2" of ambient temp. sensor and terminal "22" of A/C contr unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

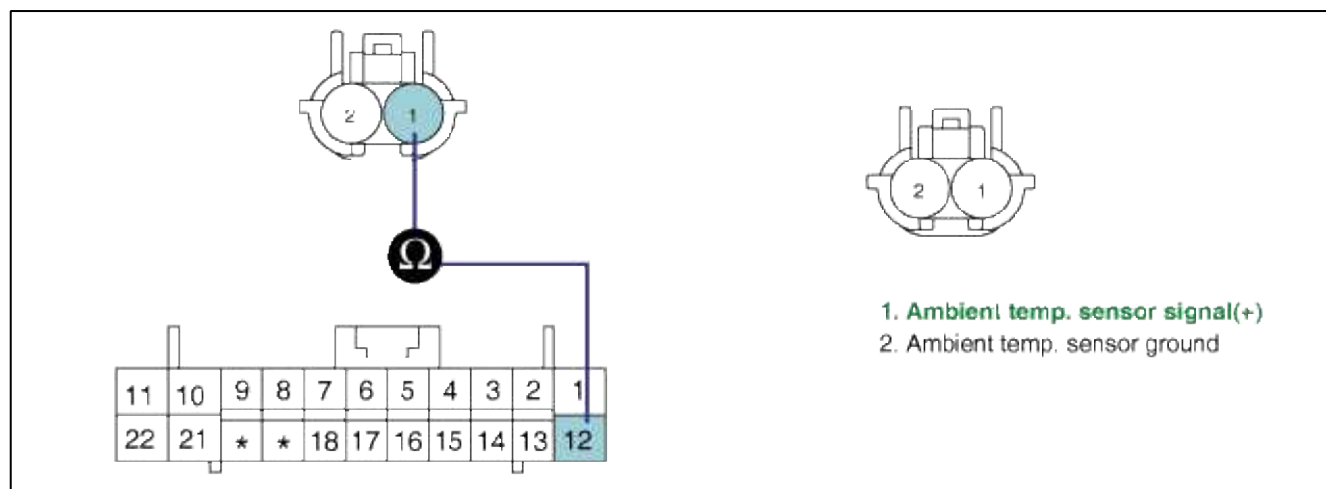
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect ambient temp. sensor.

(3) Measure resistance between terminal "1" of ambient temp. sensor and terminal "12" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

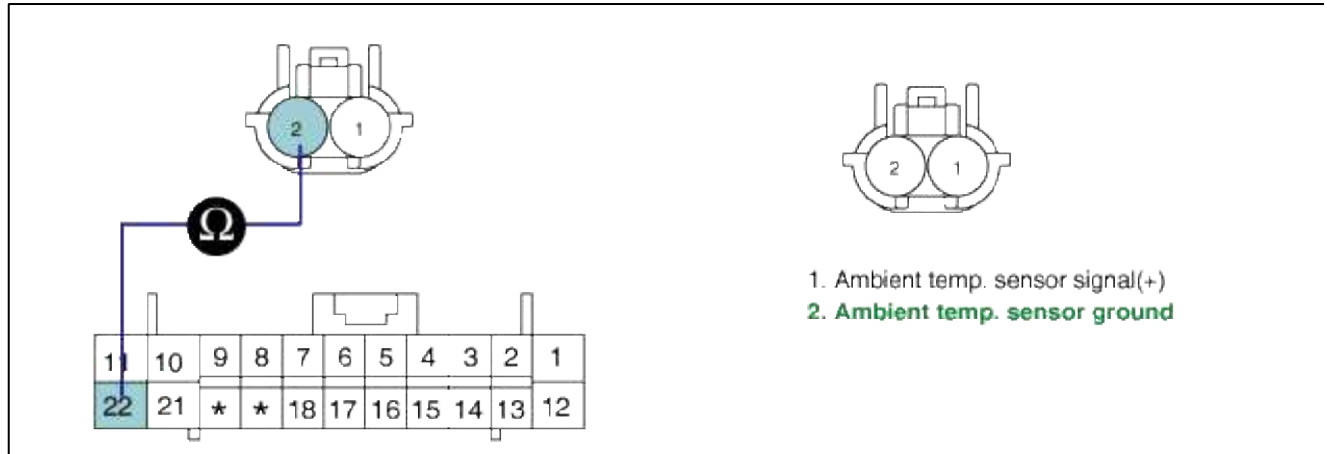
**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect ambient temp. sensor.
  - (3) Measure resistance between terminal "2" of ambient temp. sensor and terminal "22" of A/C contr unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

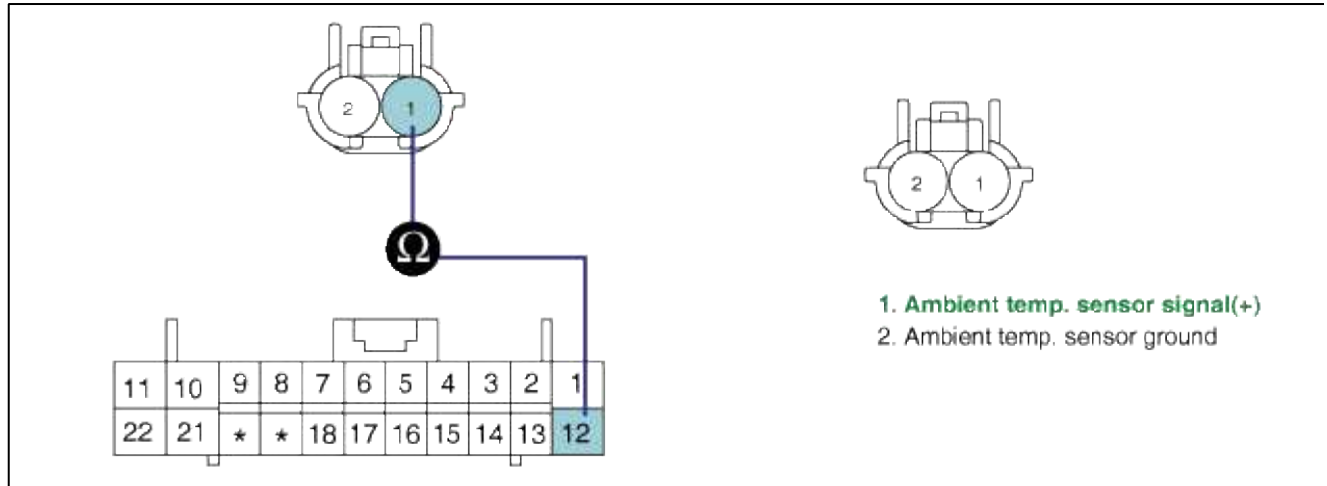
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect ambient temp. sensor.
  - (3) Measure resistance between terminal "1" of ambient temp. sensor and terminal "12" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

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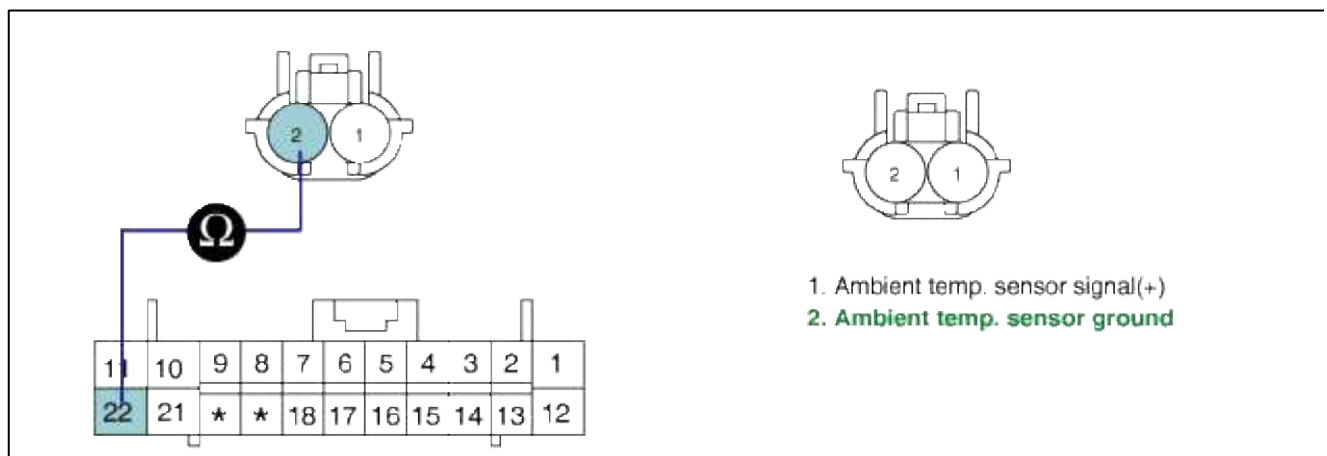
**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect ambient temp. sensor.
  - (3) Measure resistance between terminal "2" of ambient temp. sensor and terminal "22" of A/C contr unit.

Specification : Approx. 0  $\Omega$





(4) Is the measured resistance within specifications?

**YES**

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**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

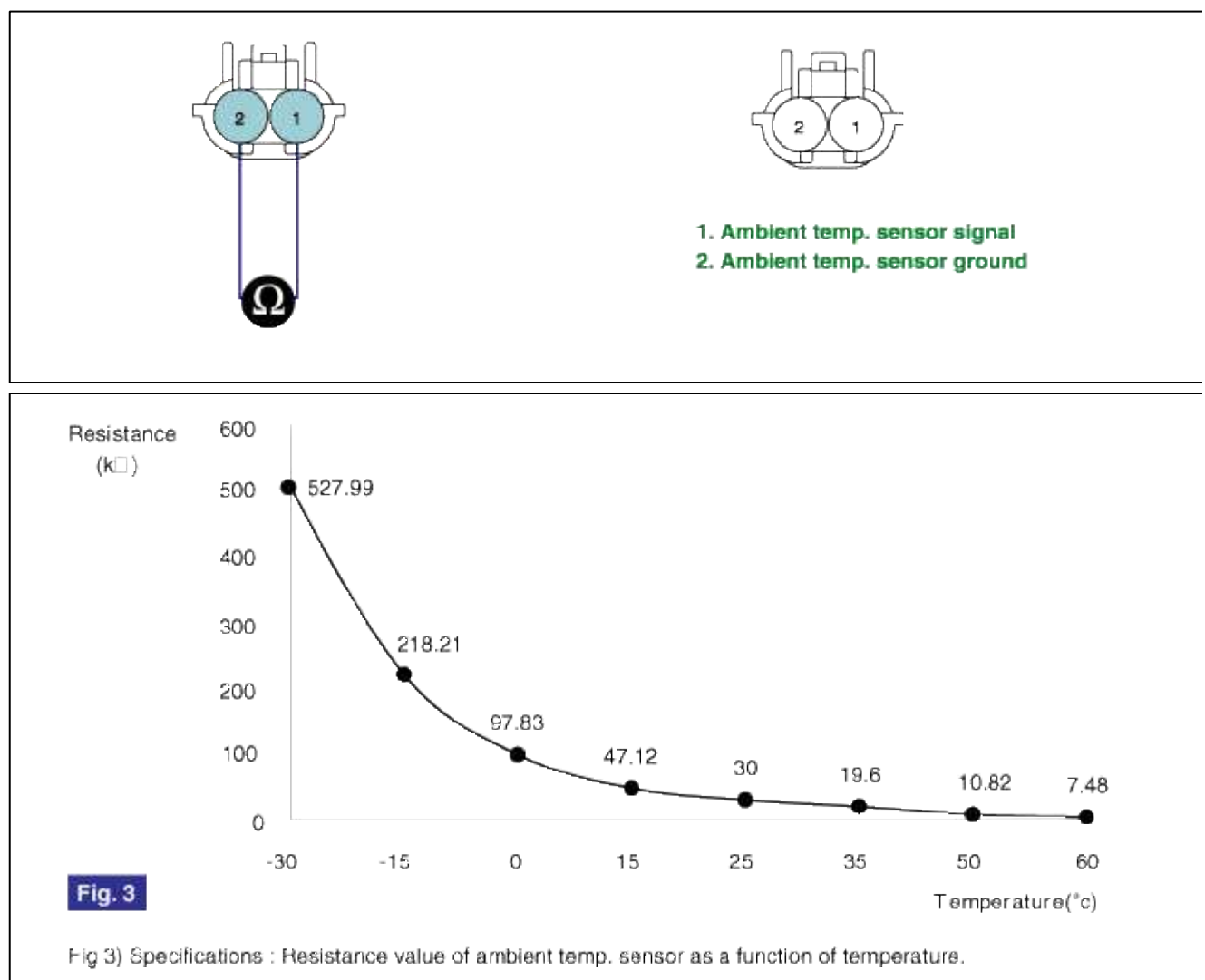
1. Check Ambient temp. sensor.

(1) Ignition "OFF"

(2) Disconnect ambient temp. sensor.

(3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.

Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

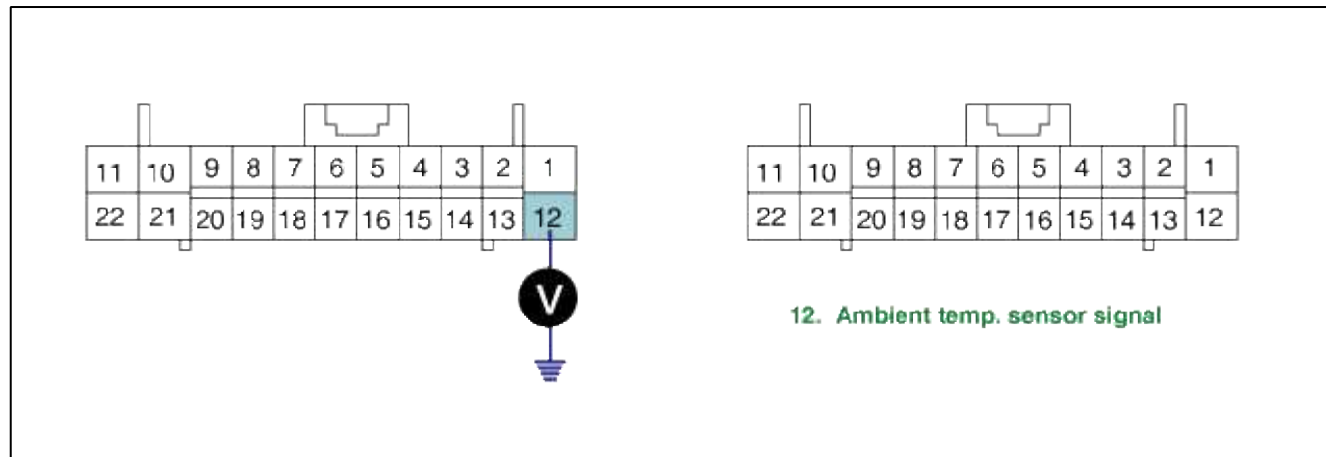
Substitute with a known-good ambient temp. sensor and check for proper operation.

If the problem is corrected, replace ambient temp. sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect ambient temp. sensor.
- (3) Measure voltage between terminal "12" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

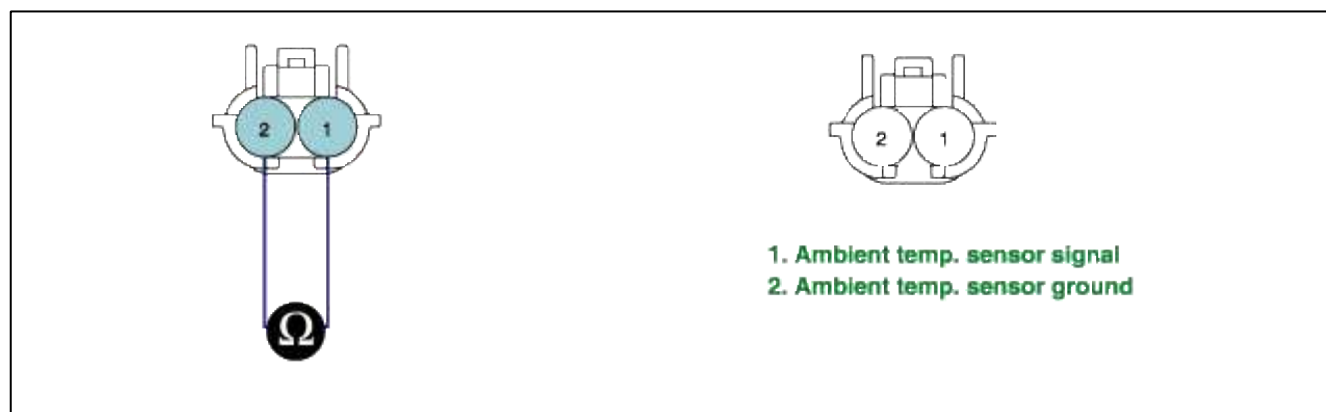
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check Ambient temp. sensor.

- (1) Ignition "OFF"
- (2) Disconnect ambient temp. sensor.
- (3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.

Specification : Refer the specifications in fig 3.



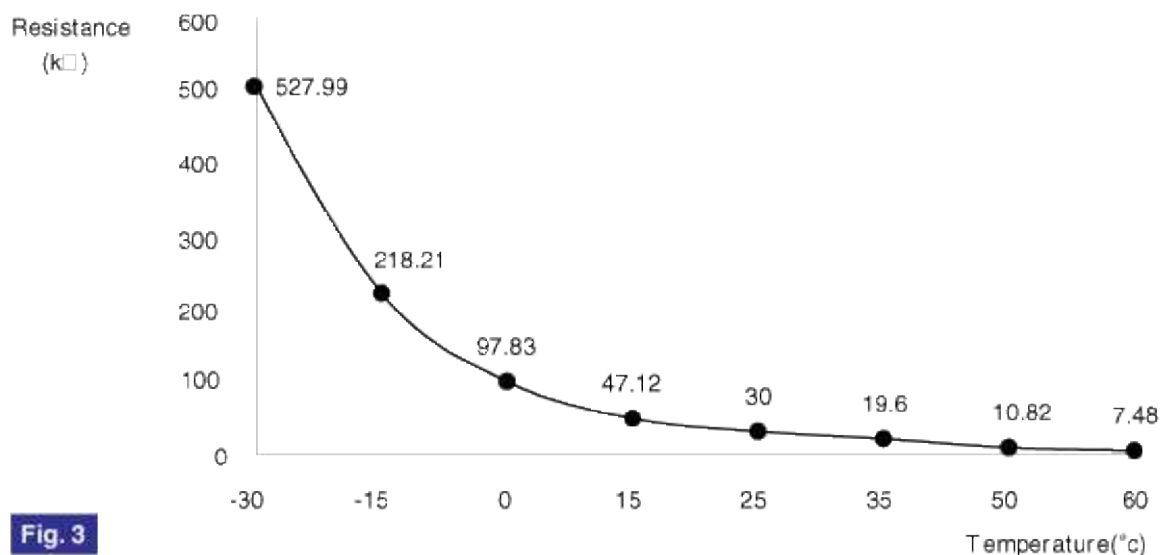


Fig 3) Specifications : Resistance value of ambient temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good ambient temp. sensor and check for proper operation.

If the problem is corrected, replace ambient temp. sensor and then go to "Verification of Vehicle Repair" procedure.

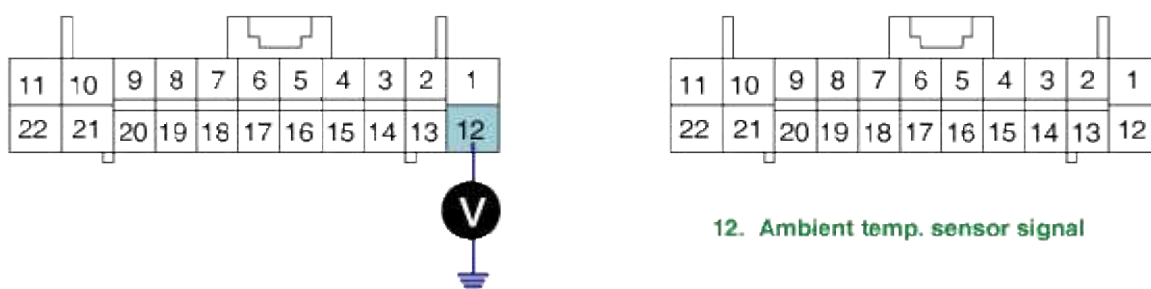
## 2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect ambient temp. sensor.

(3) Measure voltage between terminal "12" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

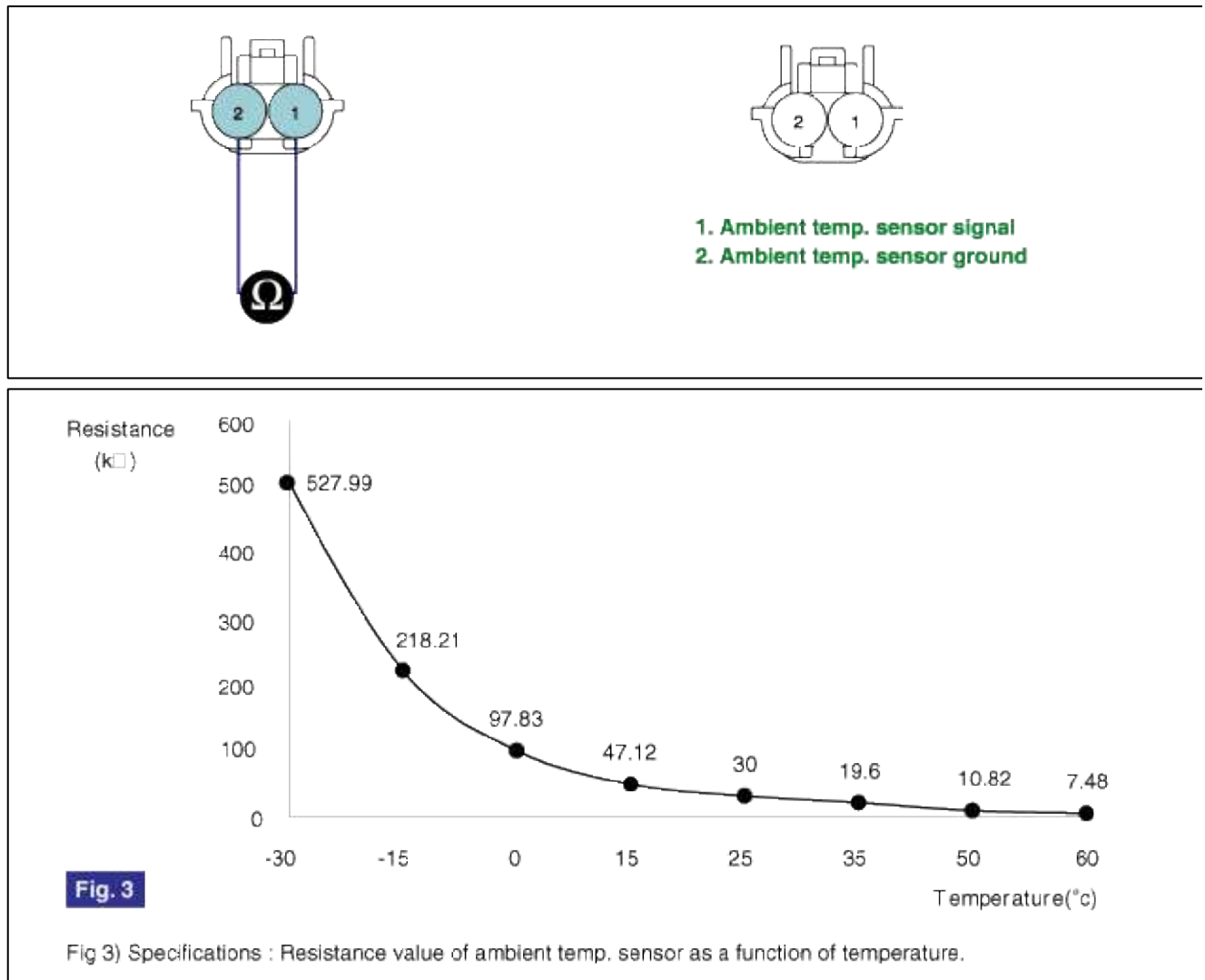
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check Ambient temp. sensor.

- (1) Ignition "OFF"
- (2) Disconnect ambient temp. sensor.
- (3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.

Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good ambient temp. sensor and check for proper operation.

If the problem is corrected, replace ambient temp. sensor and then go to "Verification of Vehicle Repair" proc

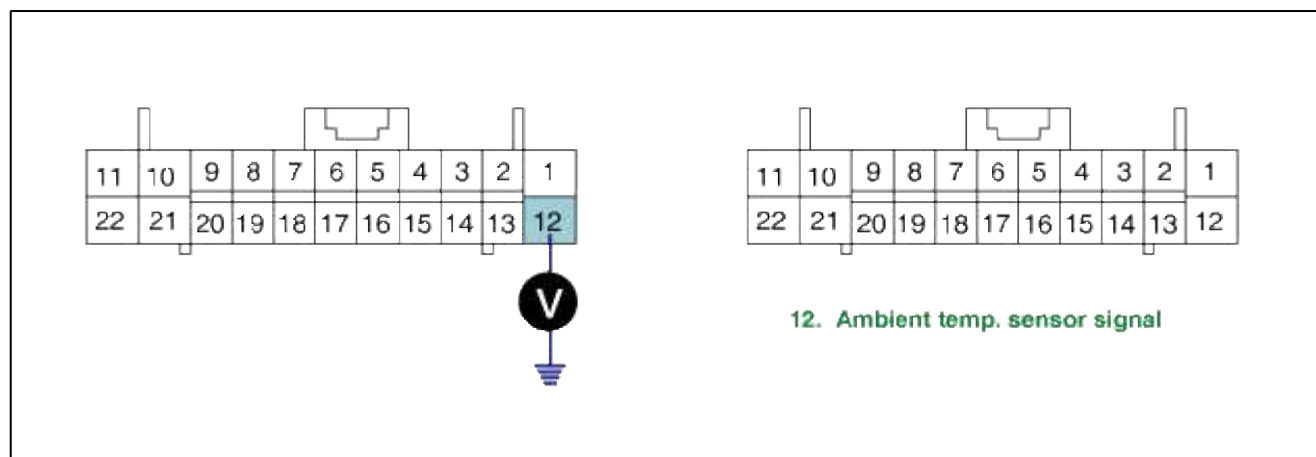
## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect ambient temp. sensor.
- (3) Measure voltage between terminal "12" of A/C Control Unit and chassis ground.

---

Specification : Approx. 5V

---



## (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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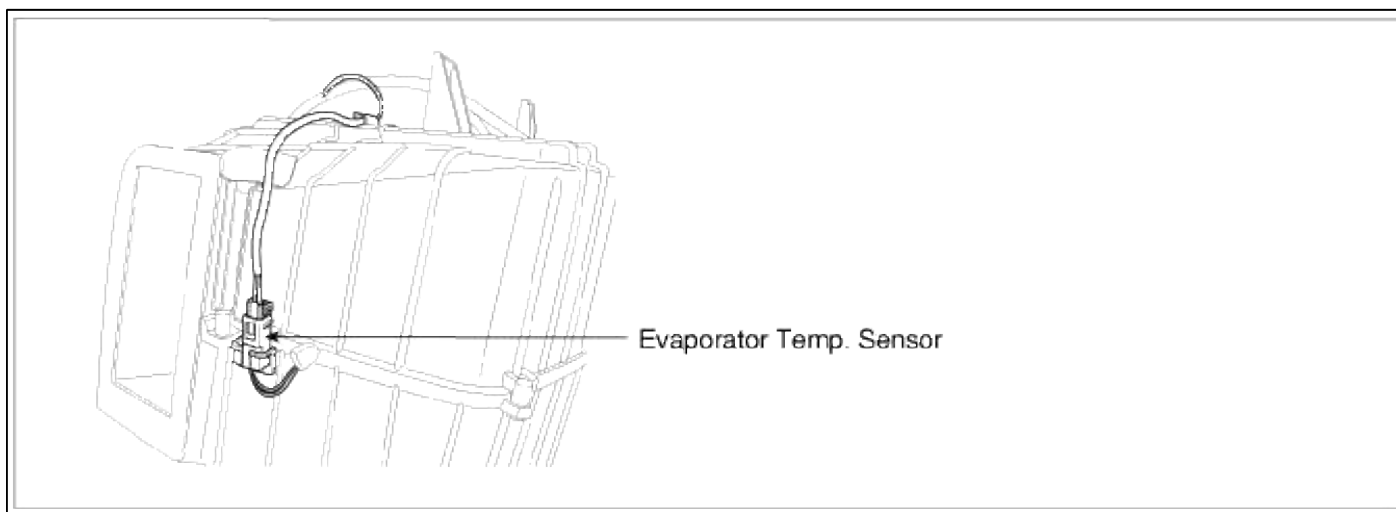
Go to the applicable troubleshooting procedure.

**NO**

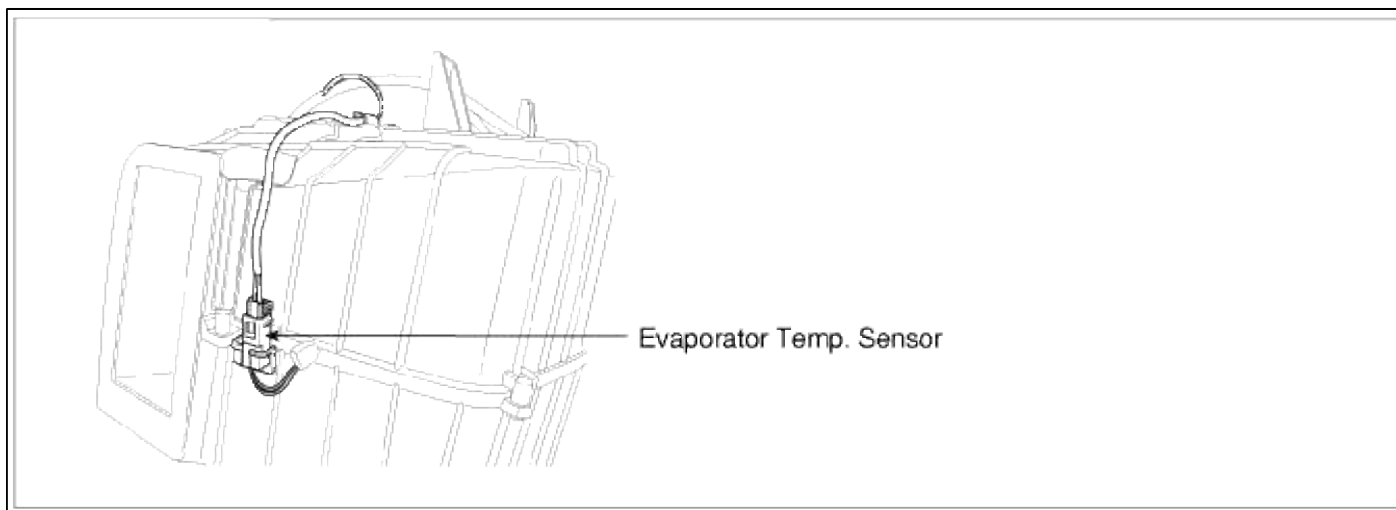
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1241

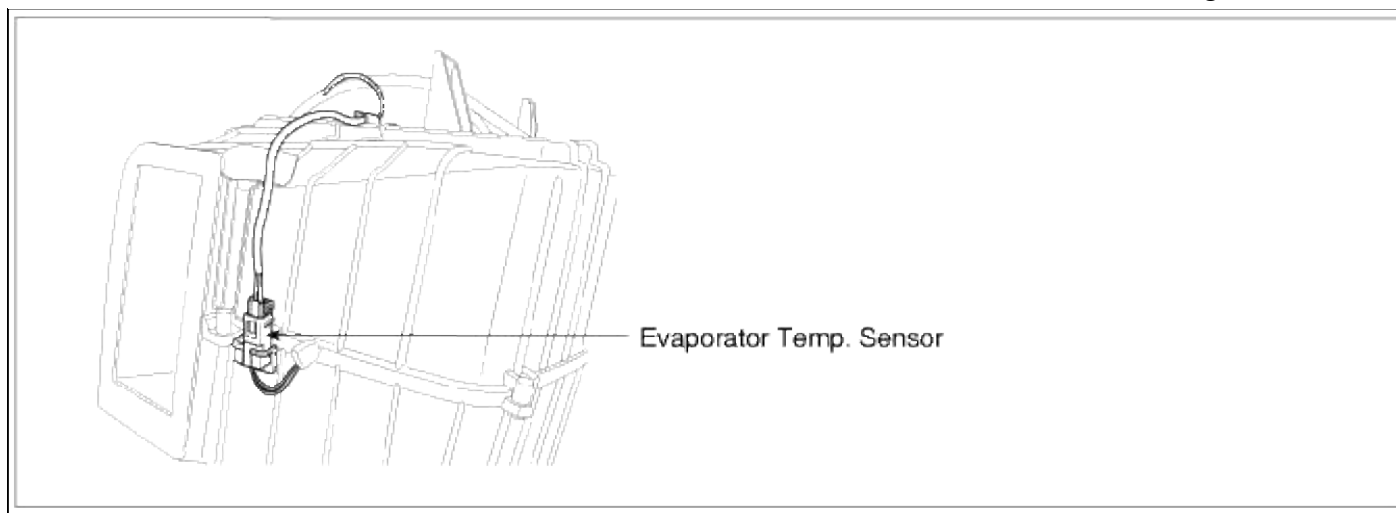
#### COMPONENT LOCATION



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#### GENERAL DESCRIPTION

The Evaporator temperature sensor located on heater unit, detects the core temperature and interrupts compressor relay power, in order to prevent evaporator freezing by excessive cooling. It is a negative type thermistor whose resistance is inversely proportional to temperature.

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#### DTC DESCRIPTION

The A/C controller sets DTC B1241 if there is a short circuit in evaporator temp. sensor signal harness or the measured resistance value of sensor is less than threshold value(about 0.9k $\Omega$ )

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty Evaporator temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• < 0.9k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

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Detecting time	• 0.3 sec	
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Threshold value	• < 0.9k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	13.0 °C
IN-CAR TEMP. SENSOR	12.0 °C
AMBIENT AIR TEMP. SNS	12.0 °C
<b>EVAPORATIVE SENSOR</b>	<b>-2.0 °C</b>
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	90.18 %
PASSENGER PHOTO SENSOR	255

**Fig. 1**

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1241.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1241 EVAP. SENSOR - LOW INPUT</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

4. Are the DTC B1241 present and is parameter of "EVAPORATIVE SENSOR" fixed?

Parameter of "EVAPORATIVE SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in EVAPORATIVE SENSOR.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.



## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

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HEATER WATER TEMP. SNSH	13.0 °C
IN-CAR TEMP. SENSOR	12.0 °C
AMBIENT AIR TEMP. SNS	12.0 °C
<b>EVAPORATIVE SENSOR</b>	<b>-2.0 °C</b>
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POSENTIO. (DR.)	91.75 %
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<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1241.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1241 EVAP. SENSOR - LOW INPUT</b>	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>	

Fig. 2

4. Are the DTC B1241 present and is parameter of "EVAPORATIVE SENSOR" fixed?

Parameter of "EVAPORATIVE SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in EVAPORATIVE SENSOR.

☐ YES

Go to "Inspection" procedure.

☐ NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"

## 3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

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IN-CAR TEMP. SENSOR	12.0 °C
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Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1241 EVAP. SENSOR - LOW INPUT</b>
NUMBER OF DTC : 1 ITEMS
PART ERAS HELP

Fig. 2

Fig 2 : DTC B1241.

## 4. Are the DTC B1241 present and is parameter of "EVAPORATIVE SENSOR" fixed?

Parameter of "EVAPORATIVE SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in EVAPORATIVE SENSOR.

☐ YES

Go to "Inspection" procedure.

☐ NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

## 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## 3. Has a problem been found?

☐ YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

☐ NO

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect evaporator temp. sensor.
  - (3) Measure resistance between terminal "1" of evaporator temp. sensor and chassis ground.

---

Specification : Approx.  $\infty\Omega$

---



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
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Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

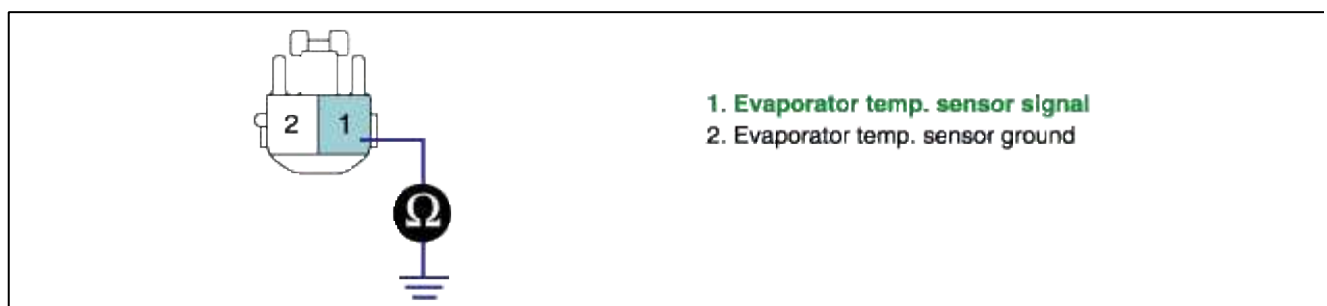
#### SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.
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## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.

(1) Ignition "OFF"

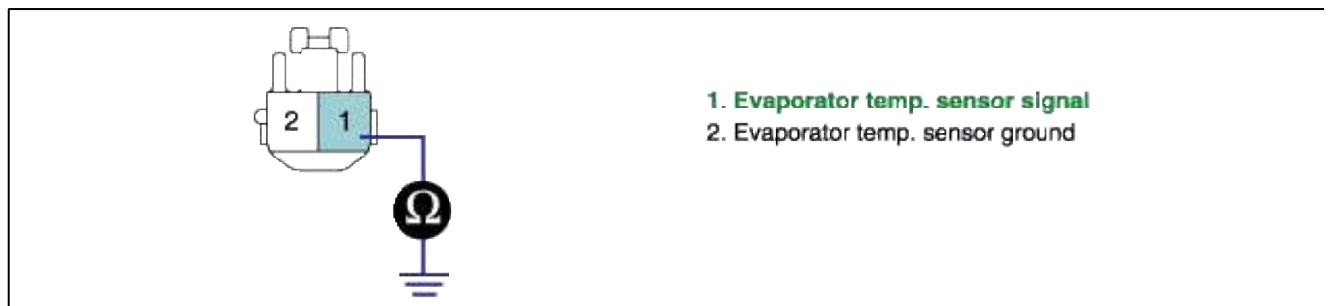
(2) Disconnect evaporator temp. sensor.

(3) Measure resistance between terminal "1" of evaporator temp. sensor and chassis ground.

---

Specification : Approx.  $\infty\Omega$

---



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

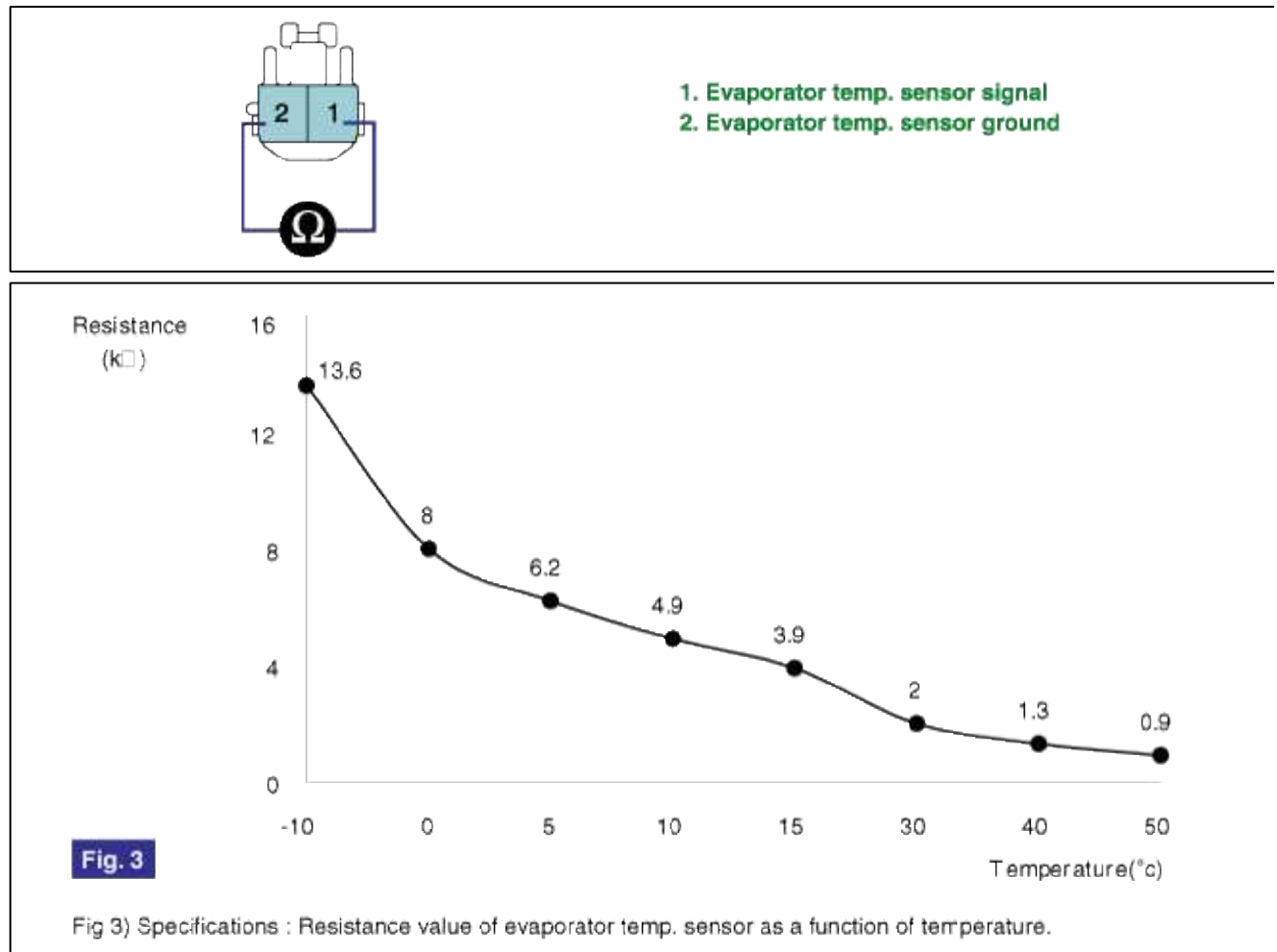
**NO**

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

1. Check evaporator temp. sensor.
  - (1) Ignition "OFF"
  - (2) Disconnect evaporator temp. sensor.
  - (3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.

Specification : Refer the specifications in fig 3.



- (4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

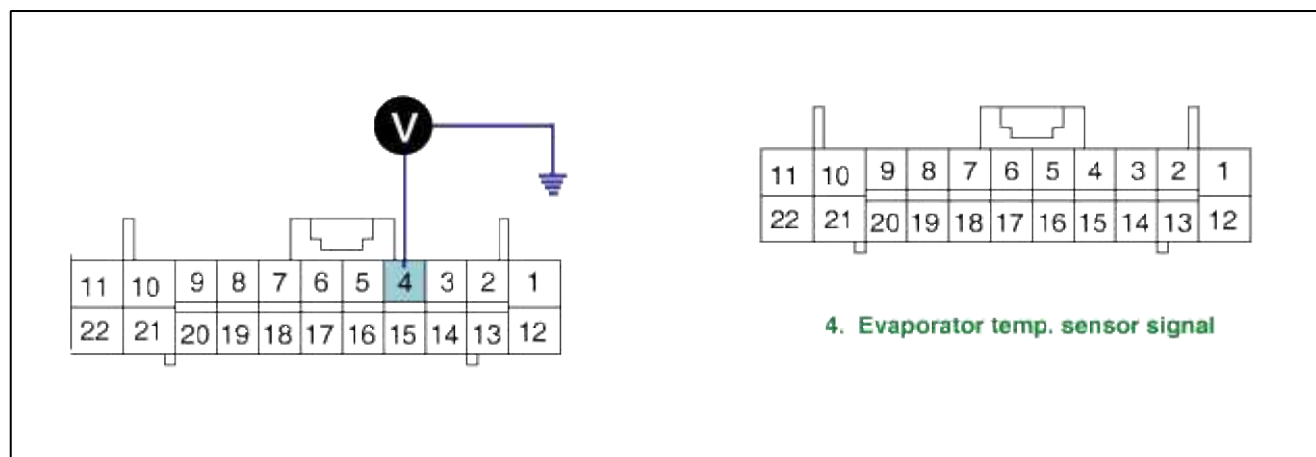
Substitute with a known-good evaporator temp. sensor and check for proper operation.

If the problem is corrected, replace evaporator temp. sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect evaporator temp. sensor.
- (3) Measure voltage between terminal "4" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

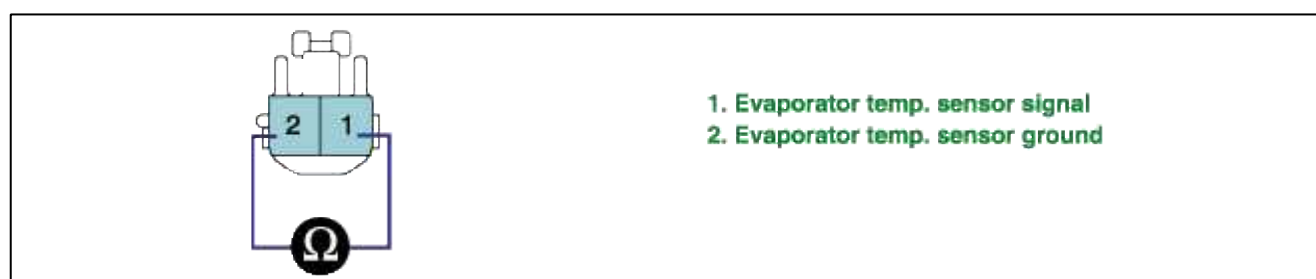
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check evaporator temp. sensor.

- (1) Ignition "OFF"
- (2) Disconnect evaporator temp. sensor.
- (3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.

Specification : Refer the specifications in fig 3.



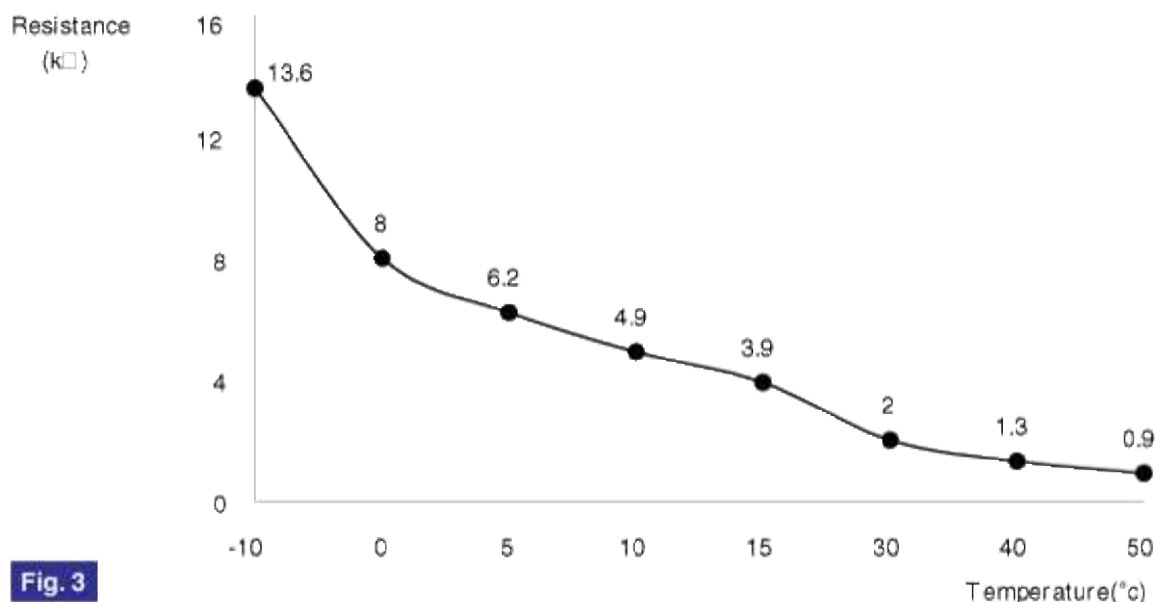


Fig. 3

Fig 3) Specifications : Resistance value of evaporator temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

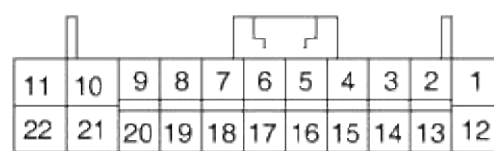
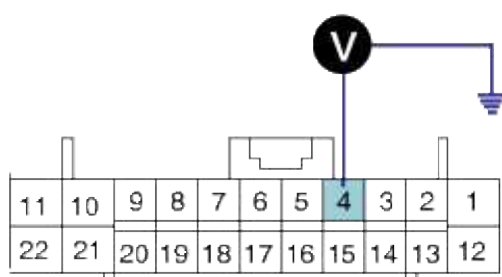
Substitute with a known-good evaporator temp. sensor and check for proper operation.

If the problem is corrected, replace evaporator temp. sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect evaporator temp. sensor.
- (3) Measure voltage between terminal "4" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



4. Evaporator temp. sensor signal

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

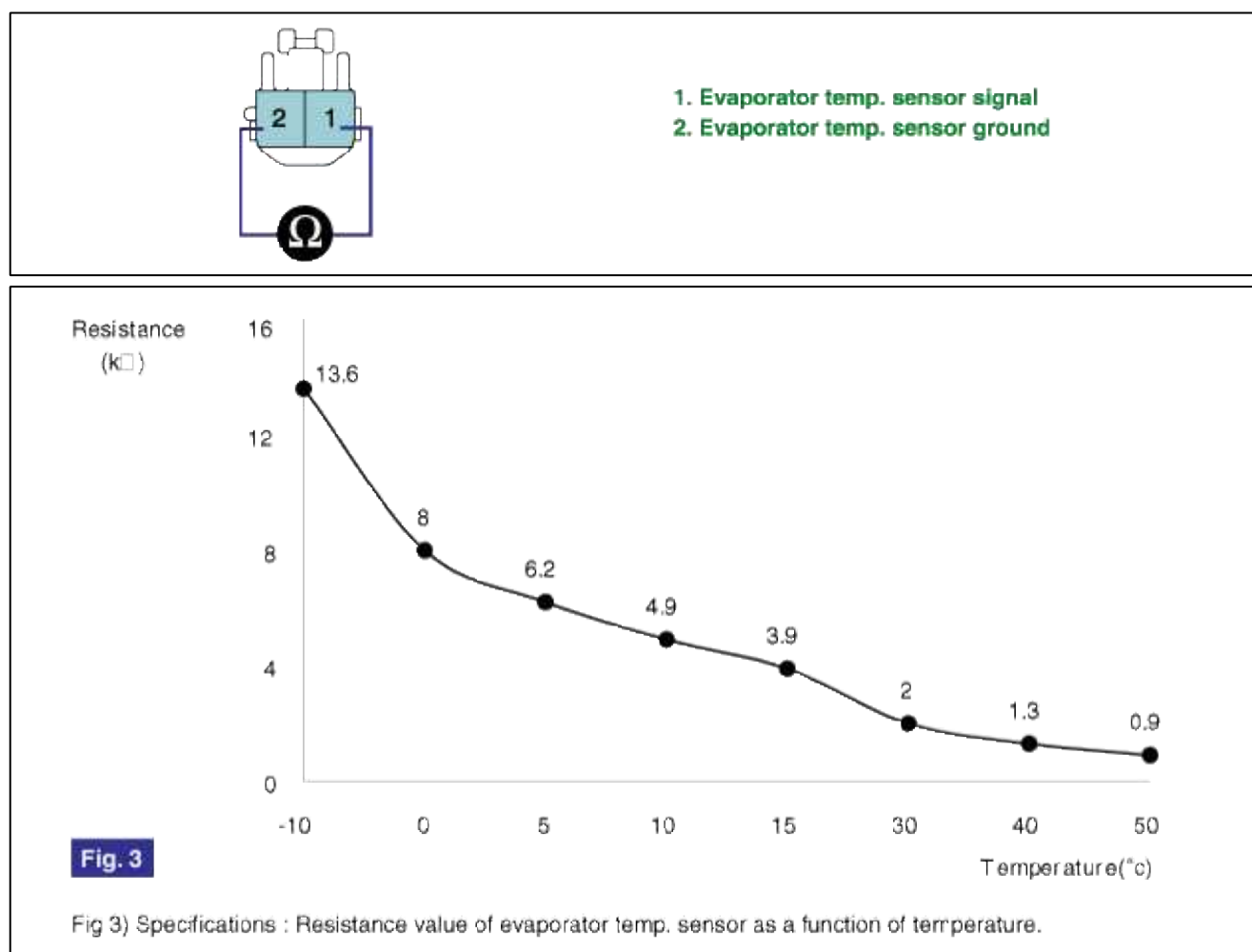
1. Check evaporator temp. sensor.

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(2) Disconnect evaporator temp. sensor.

(3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.

Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good evaporator temp. sensor and check for proper operation.

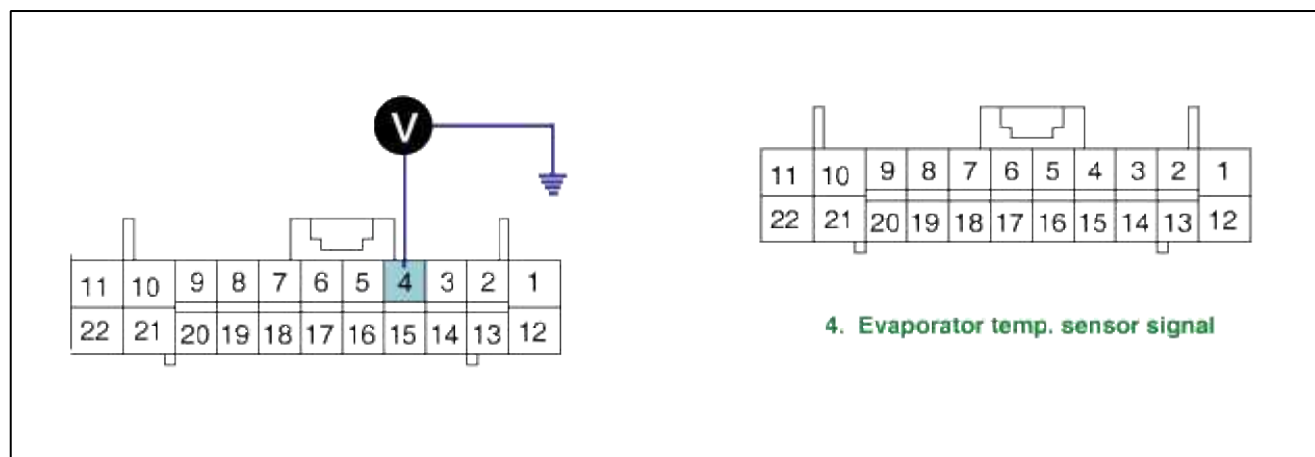
If the problem is corrected, replace evaporator temp. sensor and then go to "Verification of Vehicle Repair" procedure.



## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect evaporator temp. sensor.
- (3) Measure voltage between terminal "4" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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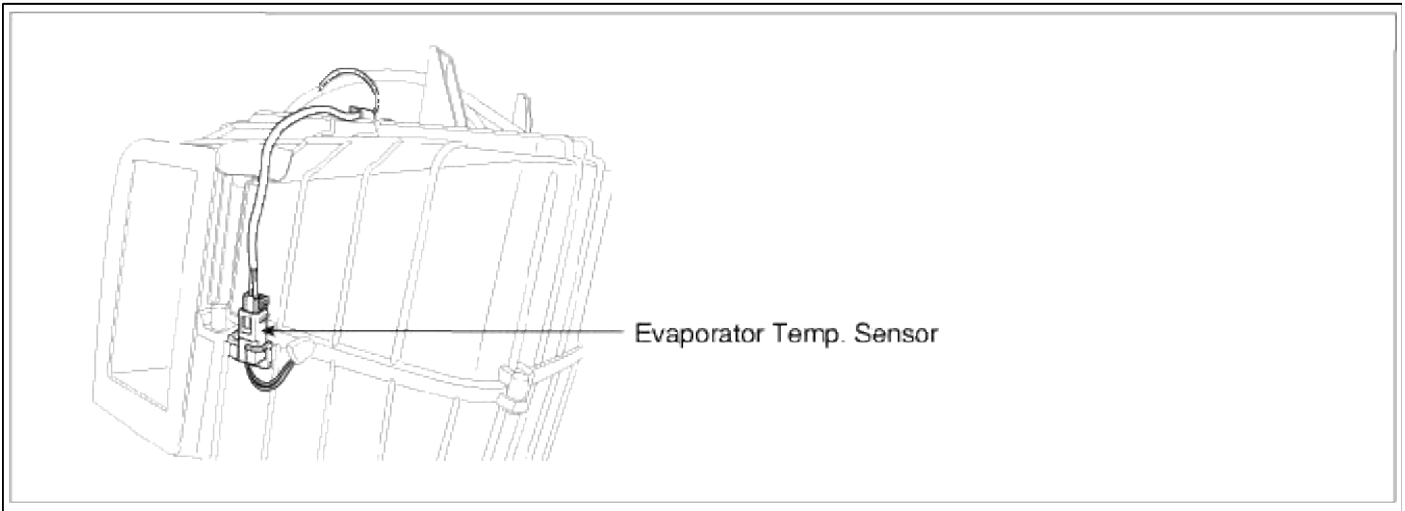
Go to the applicable troubleshooting procedure.

**NO**

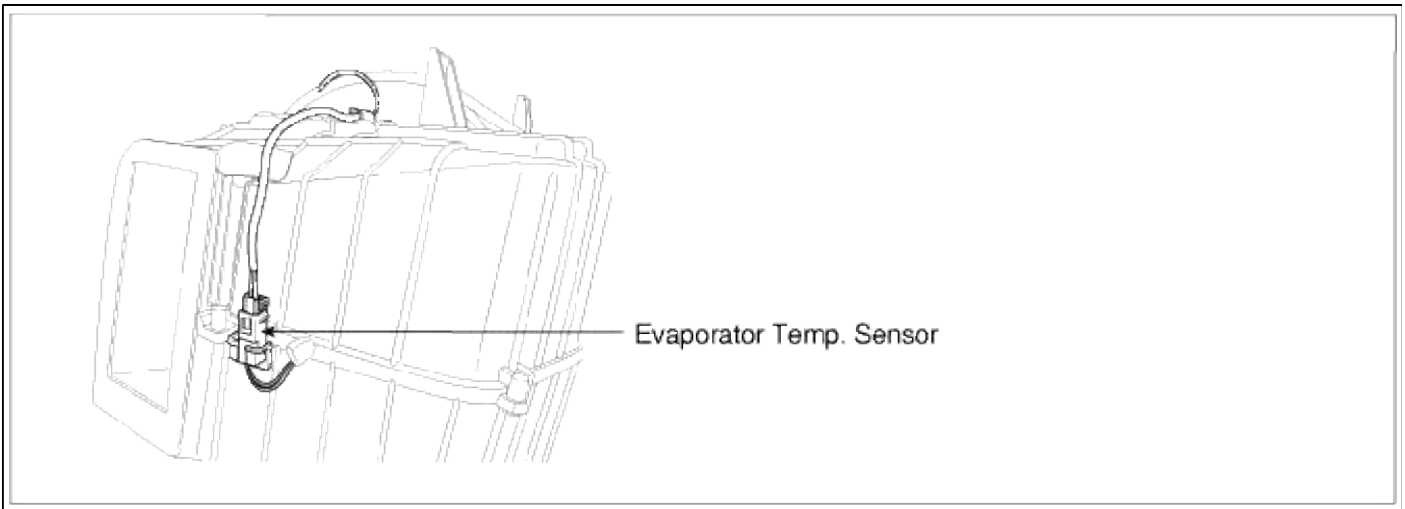
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1242

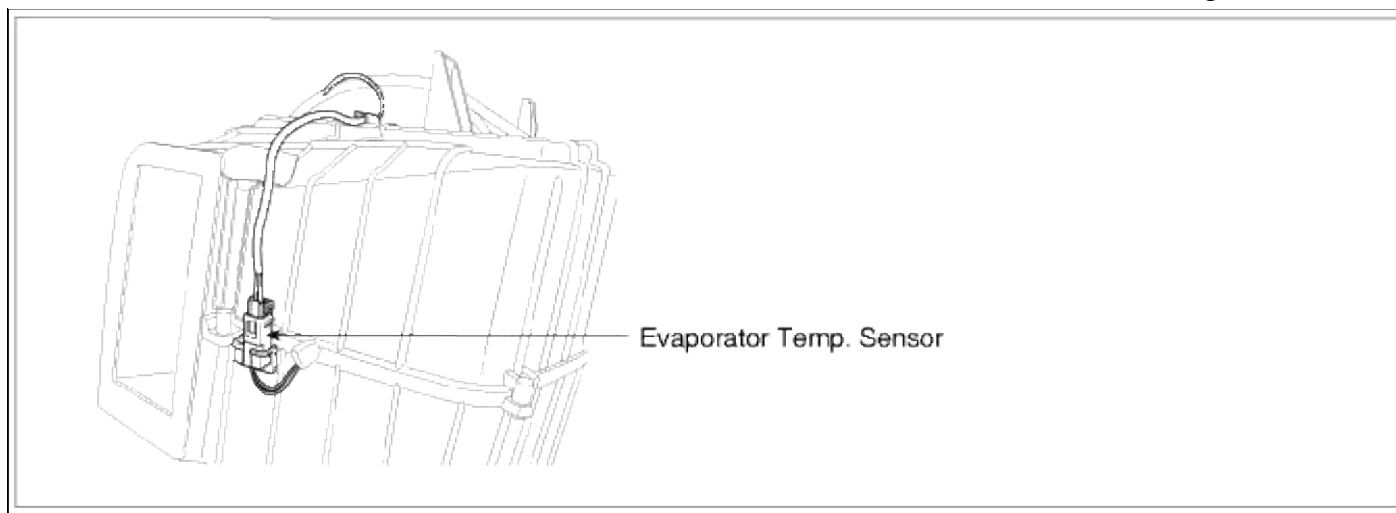
#### COMPONENT LOCATION



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#### GENERAL DESCRIPTION

The Evaporator temperature sensor located on heater unit, detects the core temperature and interrupts compressor relay power, in order to prevent evaporator freezing by excessive cooling. It is a negative type thermistor whose resistance is inversely proportional to temperature.

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#### DTC DESCRIPTION

The A/C controller sets DTC B1242 if there is an open circuit in evaporator temp. sensor signal harness or the measured resistance value of sensor is more than threshold value(about 13.6k $\Omega$ )

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Resistance check	<ul style="list-style-type: none"> <li>• Open Circuit in harness</li> <li>• Faulty Evaporator temp. Sensor</li> <li>• Faulty A/C control unit</li> </ul>
Threshold value	• > 13.6k $\Omega$	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

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Threshold value	• > 13.6kΩ	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

1.2 CURRENT DATA	
HEATER WATER TEMP. SNSR	13.0 °C
IN-CAR TEMP. SENSOR	12.0 °C
AMBIENT AIR TEMP. SNS	12.0 °C
<b>EVAPORATIVE SENSOR</b>	<b>-2.0 °C</b>
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POSENTIO. (DR.)	91.75 %
DIRECTION POTENIO. DR.	90.18 %
PASSENGER PHOTO SENSOR	255

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1242 EVAP. SENSOR - HIGH INPUT</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

Fig 2 : DTC B1242.

4. Are the DTC B1242 present and is parameter of "EVAPORATIVE SENSOR" fixed?

Parameter of "EVAPORATIVE SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in EVAPORATIVE SENSOR.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

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IN-CAR TEMP. SENSOR	12.0 °C
AMBIENT AIR TEMP. SNS	12.0 °C
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**Fig. 1**

1.1 DIAGNOSTIC TROUBLE CODES			
B1242 EVAP. SENSOR - HIGH INPUT			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	HELP	

Fig. 2

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1242.

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Parameter of "EVAPORATIVE SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in EVAPORATIVE SENSOR.

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NUMBER OF DTC : 1 ITEMS
PART ERAS HELP

Fig. 2

Fig 2 : DTC B1242.

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## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

## 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## 3. Has a problem been found?

☐ YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

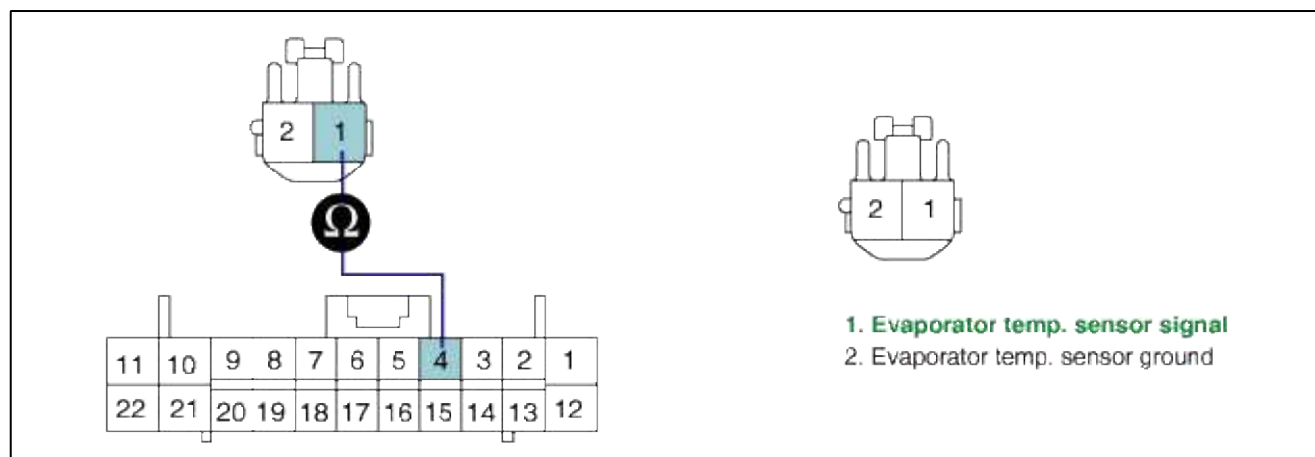
☐ NO

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect evaporator temp. sensor.
  - (3) Measure resistance between terminal "1" of evaporator temp. sensor and terminal "4" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

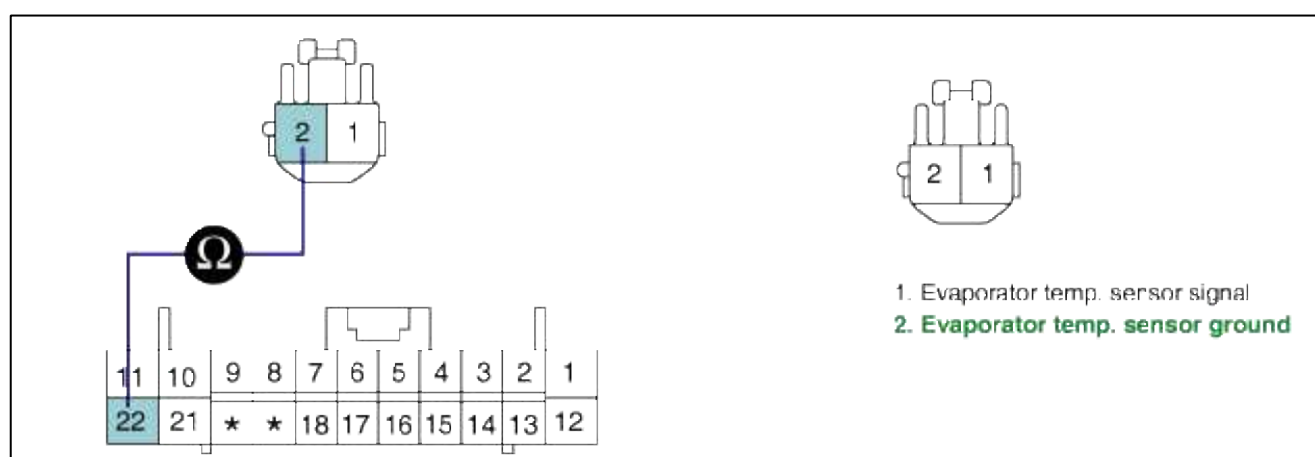
**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect evaporator temp. sensor.
  - (3) Measure resistance between terminal "2" of evaporator temp. sensor and terminal "22" A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

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**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

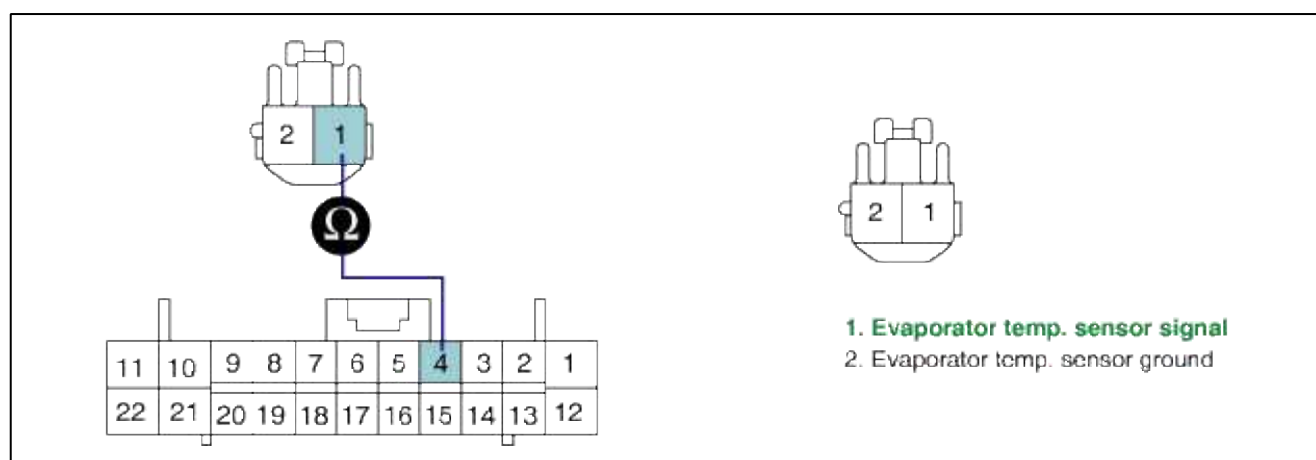
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect evaporator temp. sensor.

(3) Measure resistance between terminal "1" of evaporator temp. sensor and terminal "4" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

**NO**

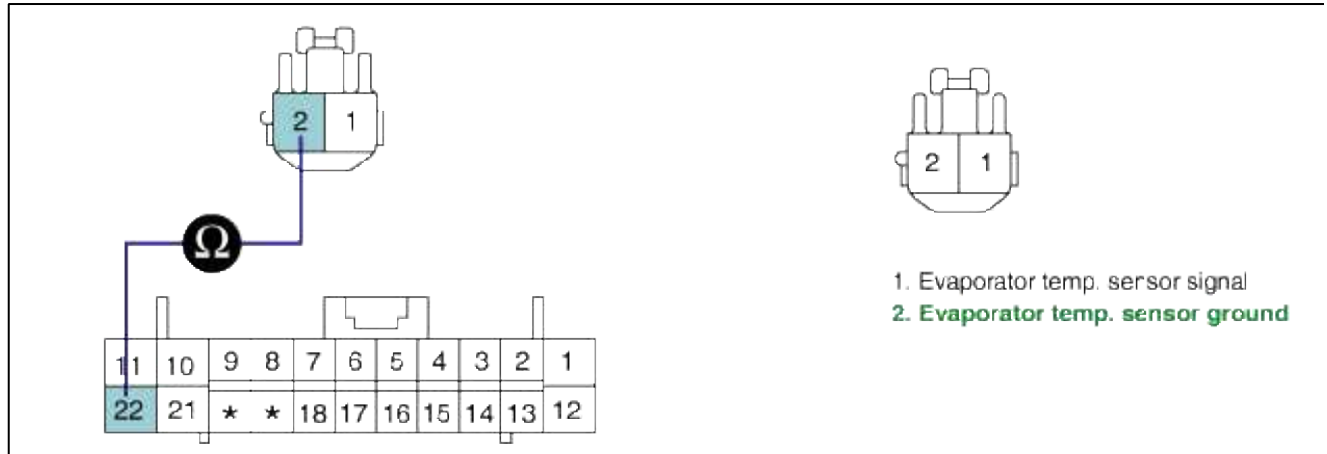
Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION



1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect evaporator temp. sensor.
  - (3) Measure resistance between terminal "2" of evaporator temp. sensor and terminal "22" A/C control unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
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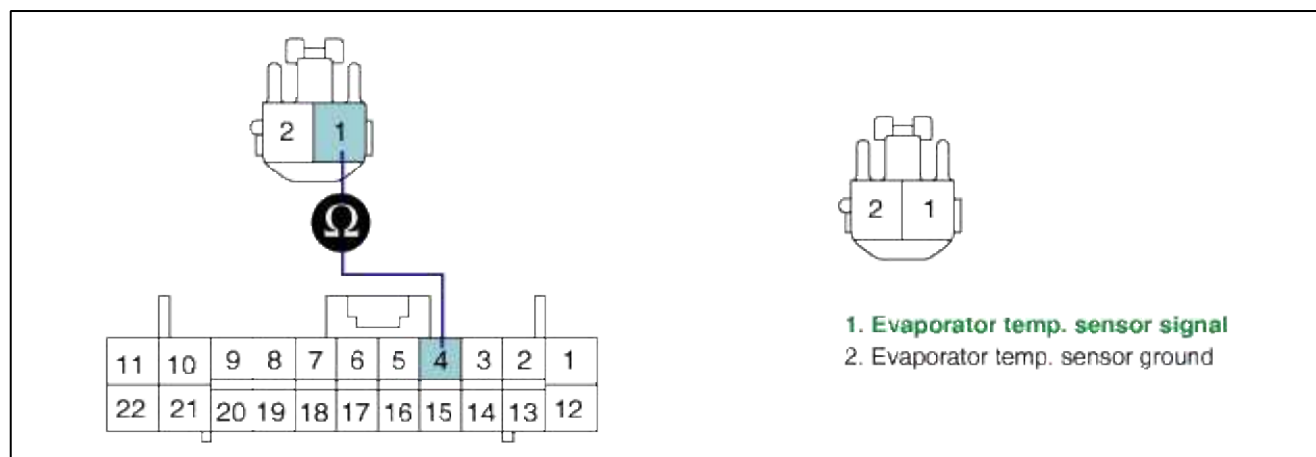
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect evaporator temp. sensor.
  - (3) Measure resistance between terminal "1" of evaporator temp. sensor and terminal "4" of A/C Control Unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection " procedure.

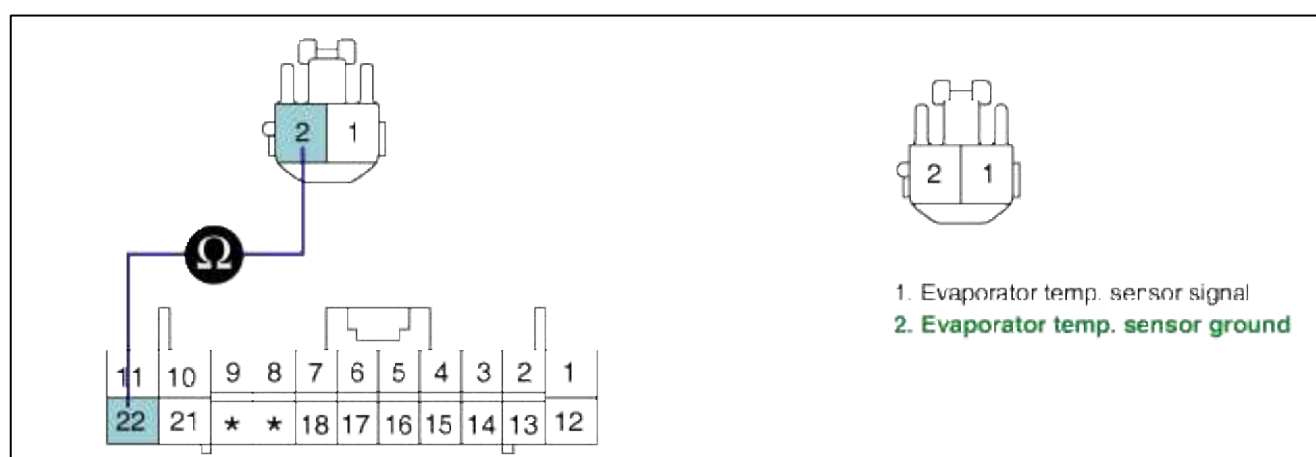
**NO**

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## GROUND CIRCUIT INSPECTION

1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect evaporator temp. sensor.
  - (3) Measure resistance between terminal "2" of evaporator temp. sensor and terminal "22" A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

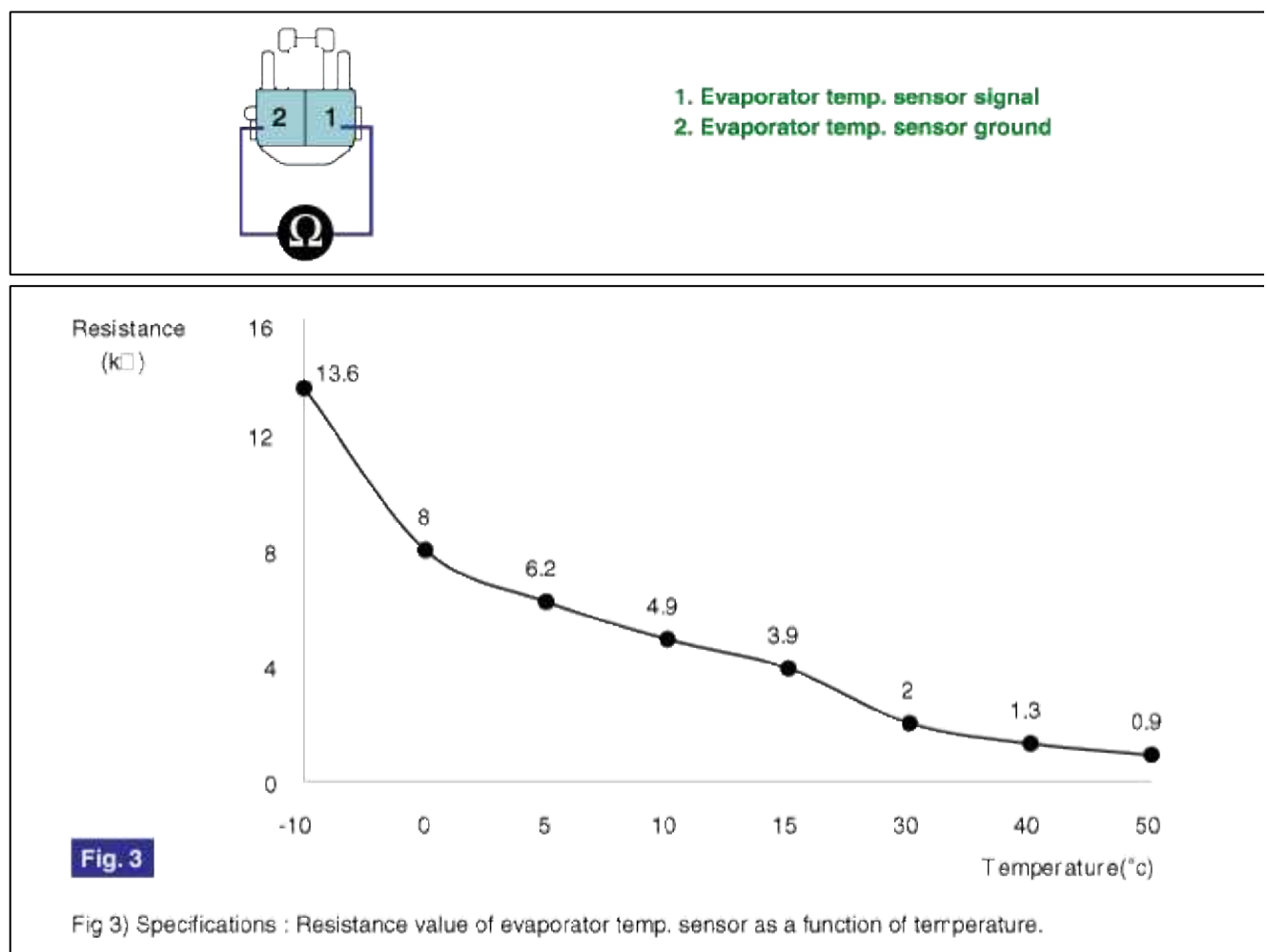
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(1) Ignition "OFF"

(2) Disconnect evaporator temp. sensor.

(3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.

Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

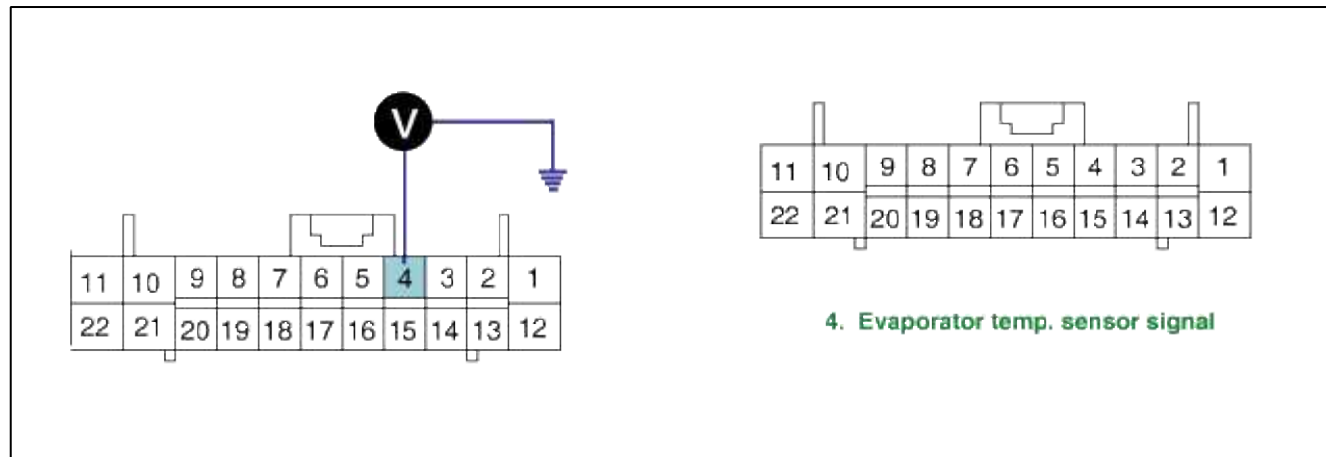
Substitute with a known-good evaporator temp. sensor and check for proper operation.

If the problem is corrected, replace evaporator temp. sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect evaporator temp. sensor.
- (3) Measure voltage between terminal "4" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

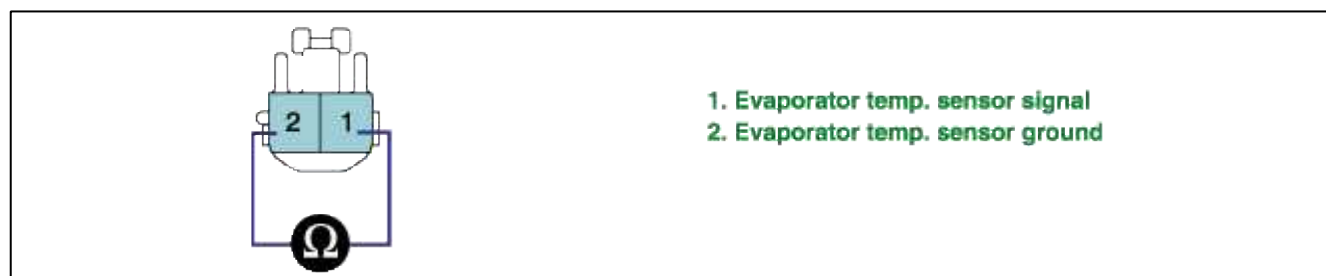
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. Check evaporator temp. sensor.

- (1) Ignition "OFF"
- (2) Disconnect evaporator temp. sensor.
- (3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.

Specification : Refer the specifications in fig 3.



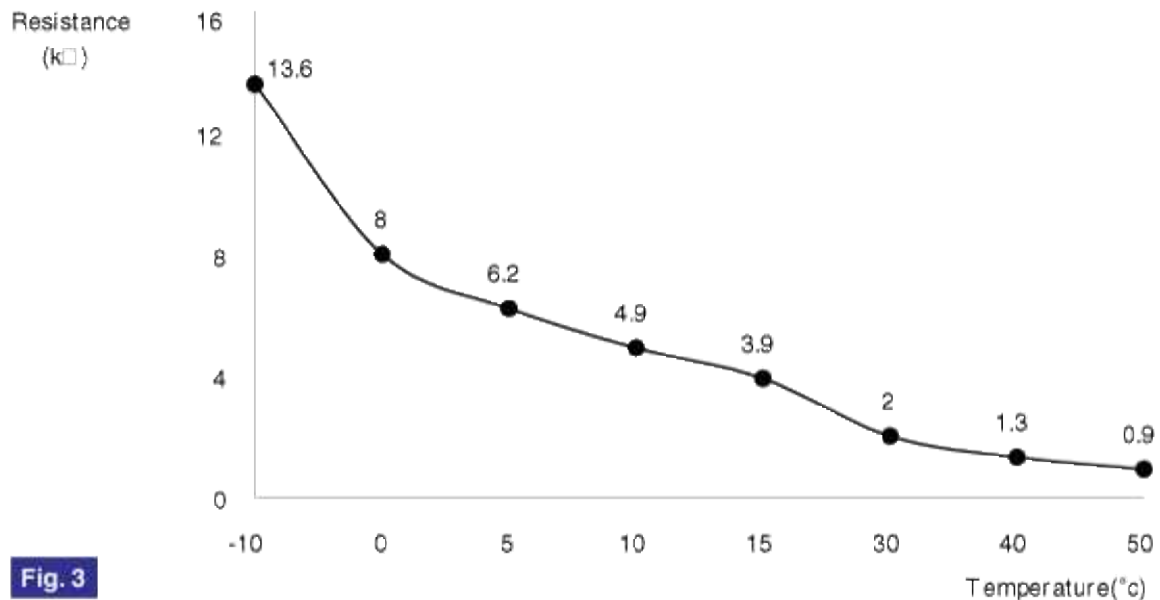


Fig 3) Specifications : Resistance value of evaporator temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

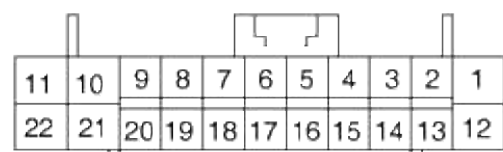
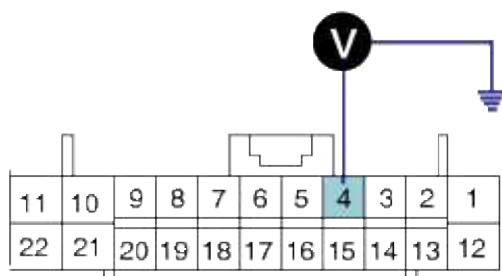
Substitute with a known-good evaporator temp. sensor and check for proper operation.

If the problem is corrected, replace evaporator temp. sensor and then go to "Verification of Vehicle Repair" procedure.

## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect evaporator temp. sensor.
- (3) Measure voltage between terminal "4" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



4. Evaporator temp. sensor signal

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

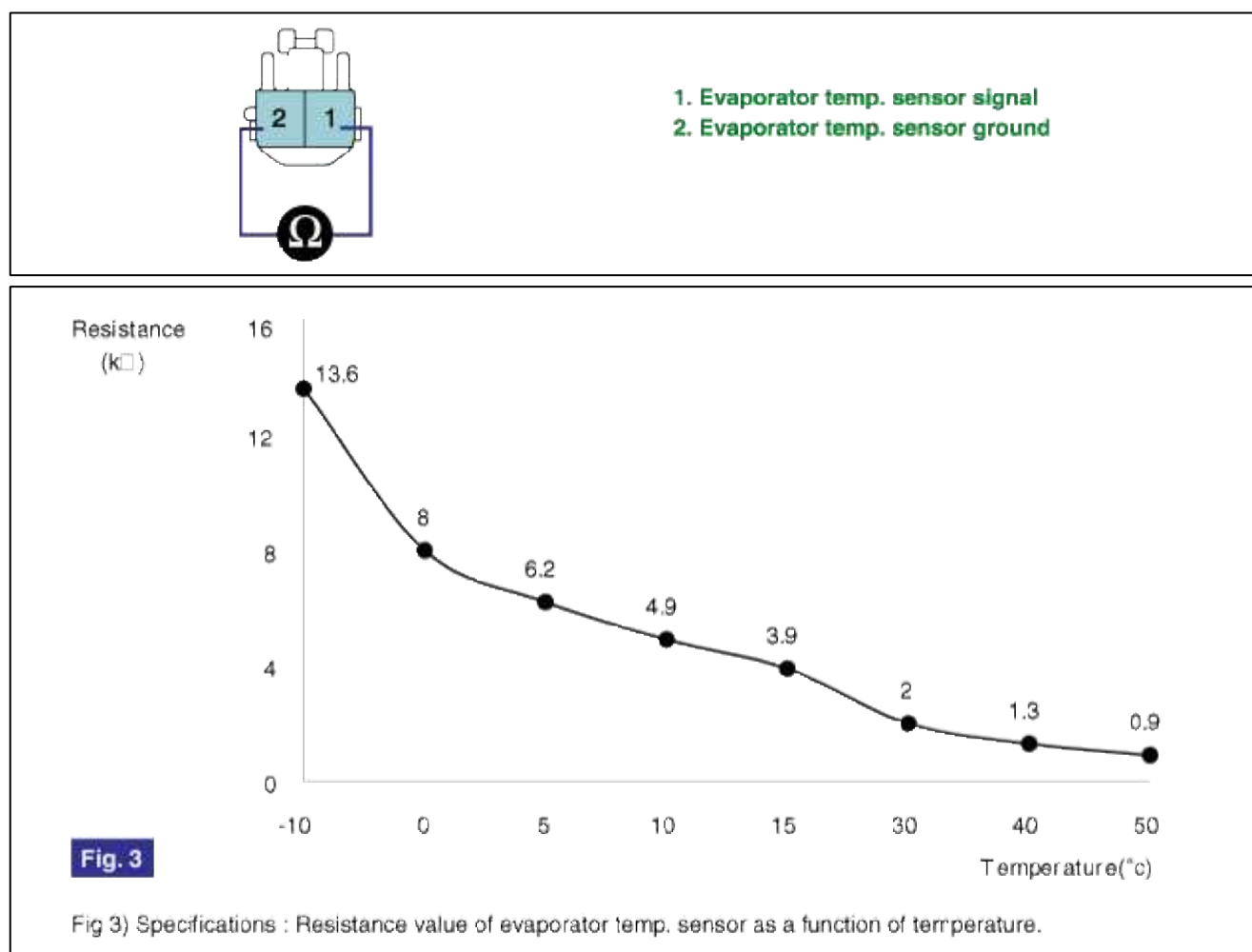
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(2) Disconnect evaporator temp. sensor.

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Specification : Refer the specifications in fig 3.



(4) Is the measured resistance within specifications in fig3? (tolerance limits  $\pm 3\%$ )

**YES**

Go to "Check A/C Control Unit" procedure.

**NO**

Substitute with a known-good evaporator temp. sensor and check for proper operation.

If the problem is corrected, replace evaporator temp. sensor and then go to "Verification of Vehicle Repair" procedure.

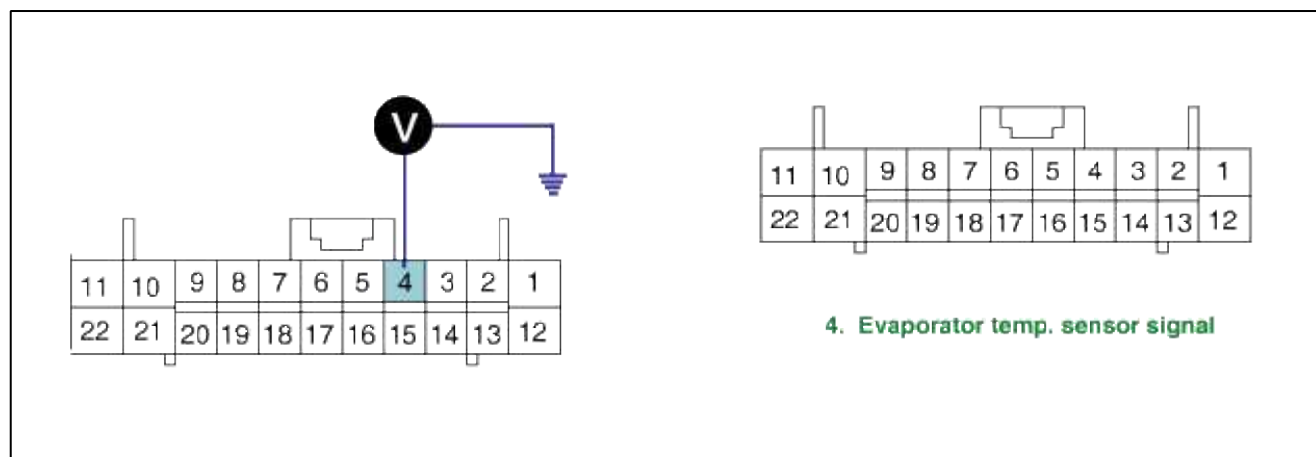
## 2. Check A/C Control Unit

- (1) Engine "ON"
- (2) Disconnect evaporator temp. sensor.
- (3) Measure voltage between terminal "4" of A/C Control Unit and chassis ground.

---

Specification : Approx. 5V

---



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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**YES**

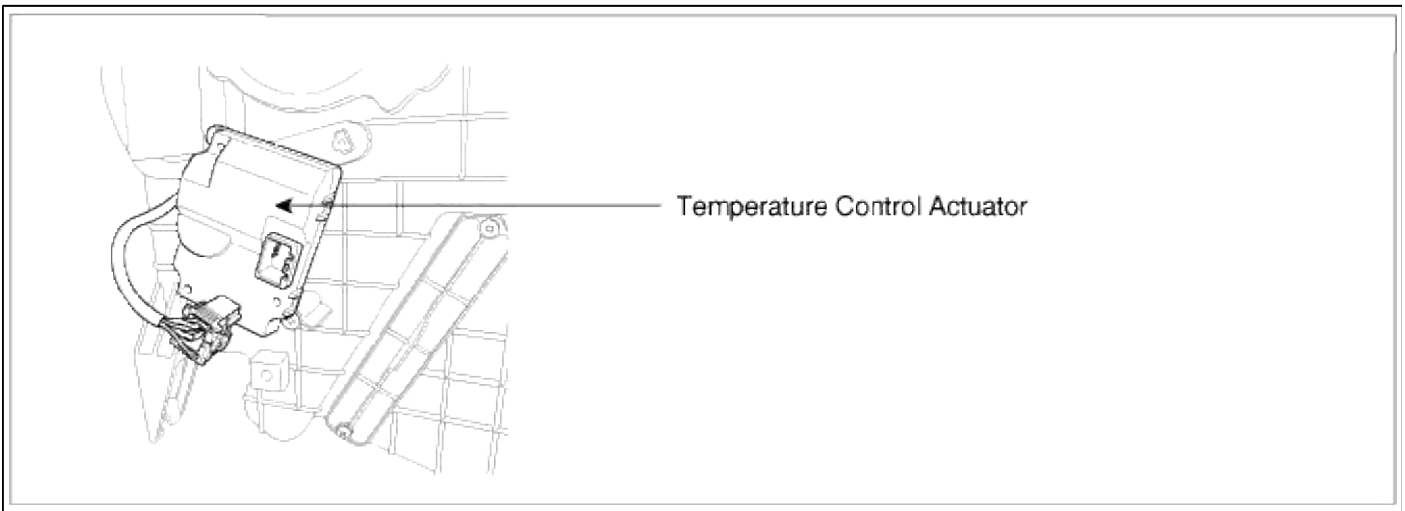
Go to the applicable troubleshooting procedure.

**NO**

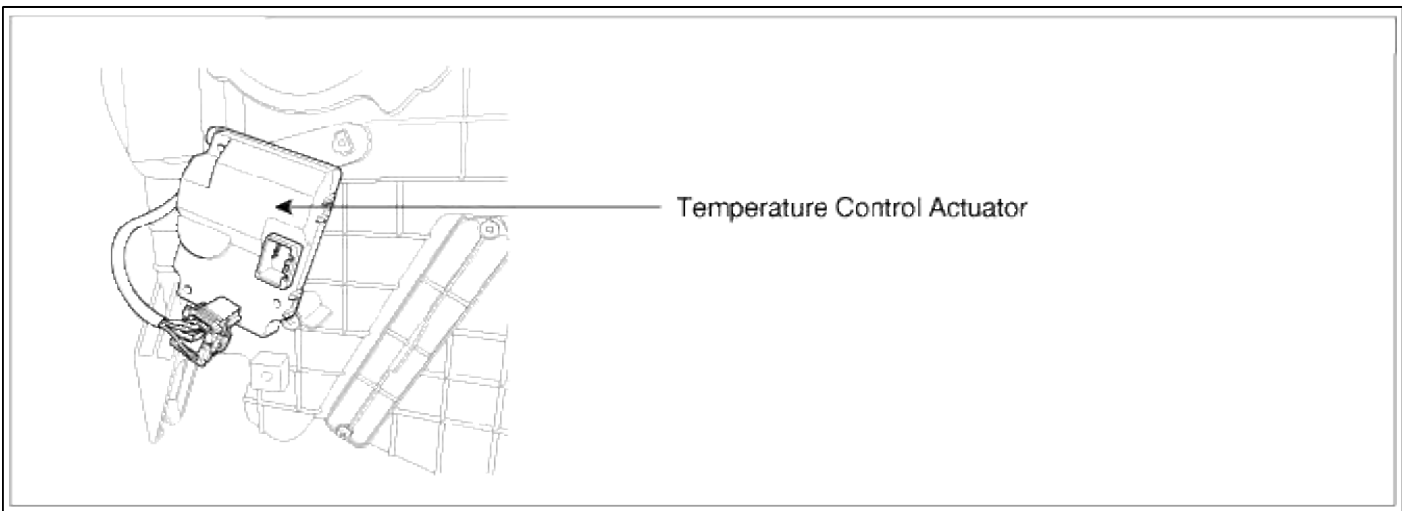
System is performing to specification at this time.

## Heating,Ventilation, Air Conditioning > Troubleshooting > B1245

### COMPONENT LOCATION

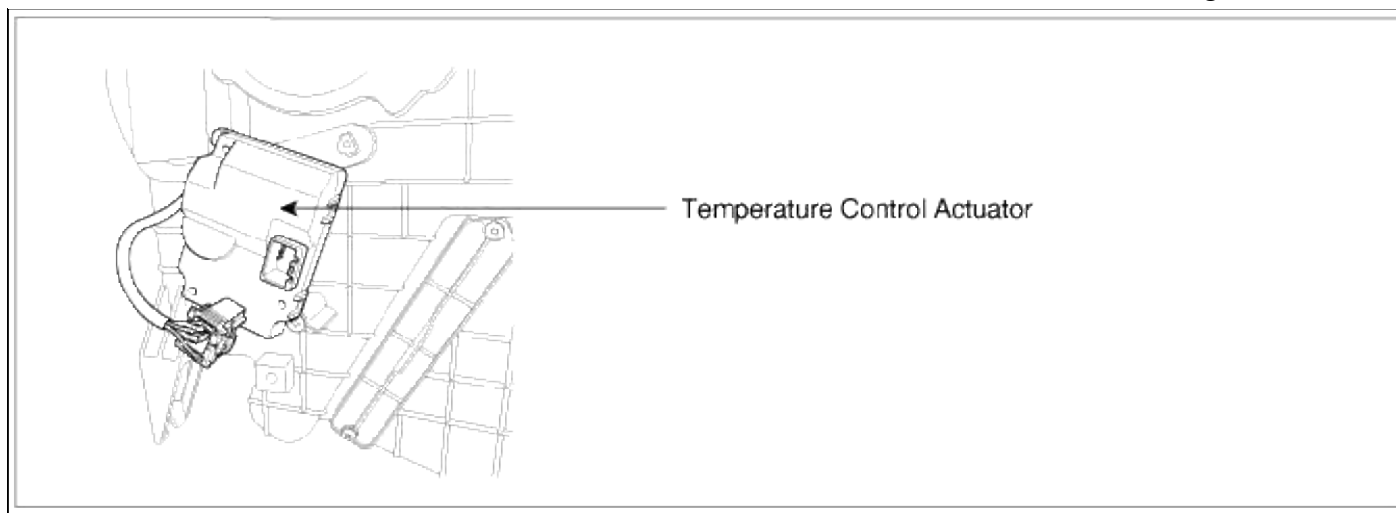


### COMPONENT LOCATION



### COMPONENT LOCATION





#### GENERAL DESCRIPTION

Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

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The A/C controller sets DTC B1245 if there is an open circuit or poor connection in the air mix potentiometer.

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#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• If temperature setting 17~24.5°C(63~76°F) fix at max. cooling position.</li> <li>• If temperature setting 25~32°C(77~90°F) fix at max. heating position.</li> </ul>	

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#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Driver Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	13.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	12.5 °C
DRIVER PHOTO SENSOR	0.00 V
<b>AIR MIX POPENTIO.</b>	<b>5.9 %</b>
DIRECTION POTENIO.DR.	90.18 %
PASSENGER PHOTO SENSOR	255
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1245 AIR MIX P. - LOW INPUT</b>
NUMBER OF DTC : 1 ITEMS
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>

**Fig. 2**

Fig 2 : DTC B1245.

## 4. Are the DTC B1245 present and is parameter of "Driver Air Mix Potentiometer" fixed?

Parameter of "Driver Air Mix Potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Air Mix potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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<b>B1245 AIR MIX P. - LOW INPUT</b>
NUMBER OF DTC : 1 ITEMS

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**YES**

Go to "Inspection" procedure.

**NO**

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## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

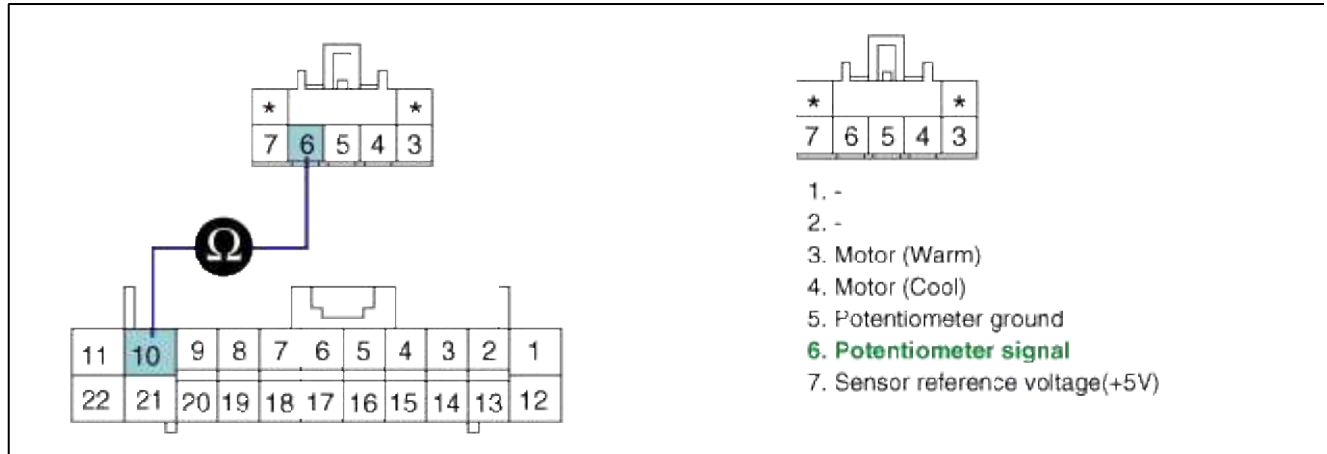
Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

## 1. Check for open in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix potentiometer.
- (3) Measure resistance between terminal "6" of Driver Air Mix Potentiometer and terminal "10" of A/C control un

Specification : Approx. 0  $\Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

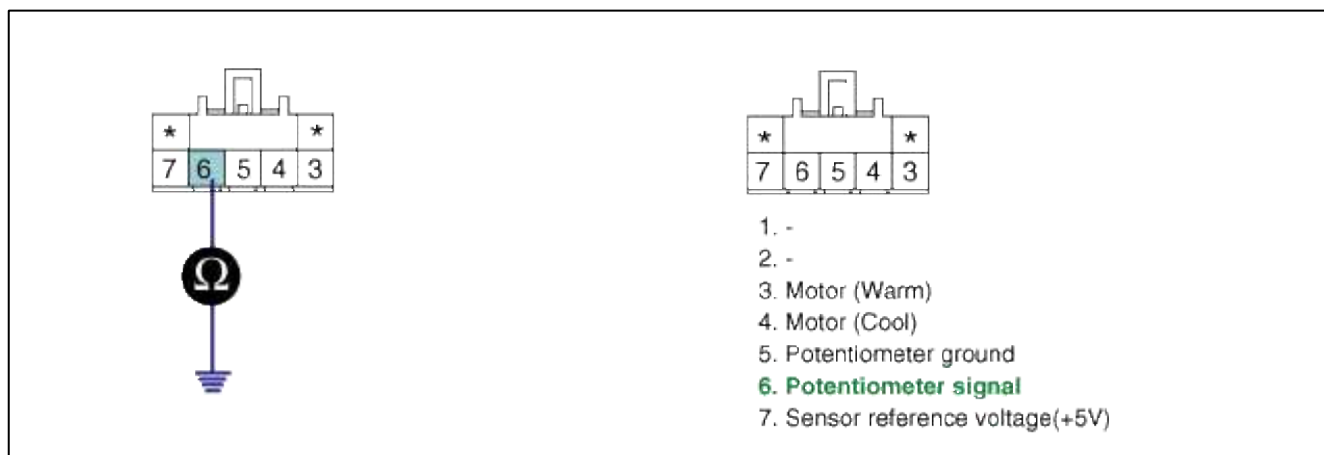
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix potentiometer.
- (3) Measure resistance between terminal "6" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx.  $\infty \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

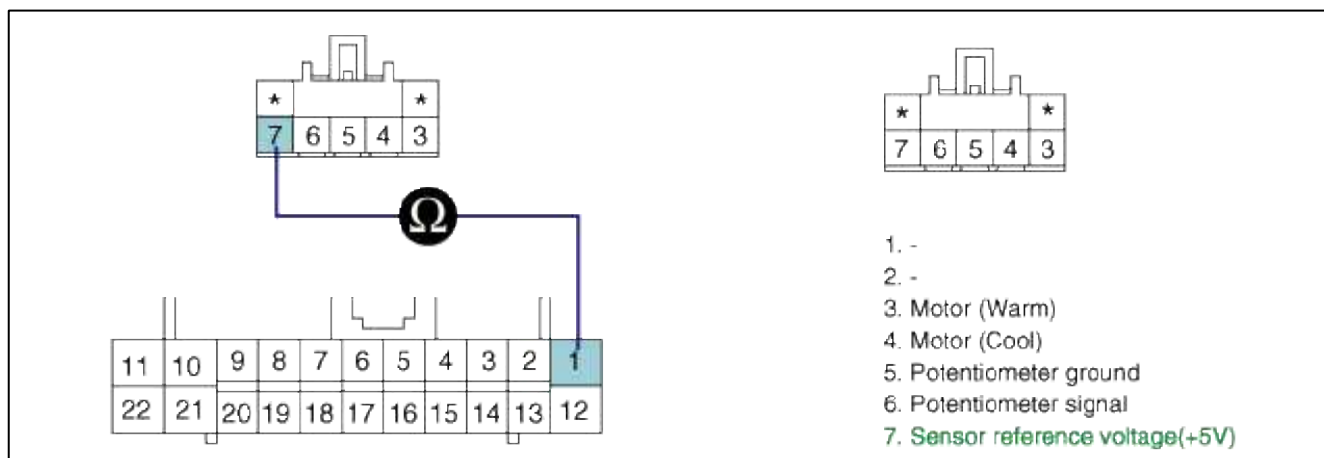
1. Check for open in harness.

(1) Ignition "ON"

(2) Connect Driver Air Mix Potentiometer.

(3) Measure resistance between terminal "3" of Driver Air Mix Potentiometer and terminal "1" of A/C control unit

Specification :  $0\Omega$



(4) Is the measured voltage within specifications?

**YES**

Go to "Component inspection" procedure.

**NO**

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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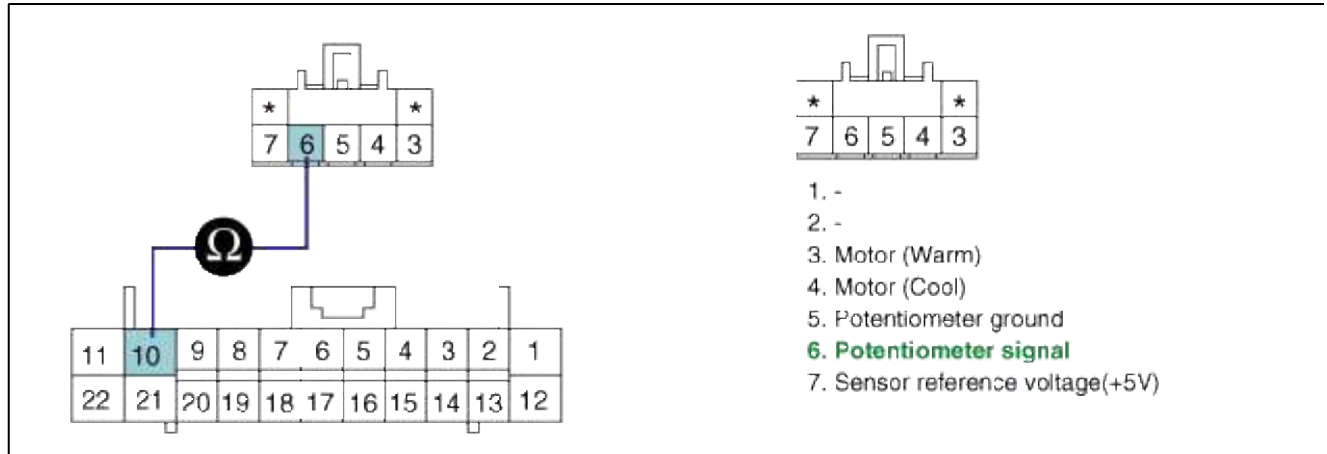
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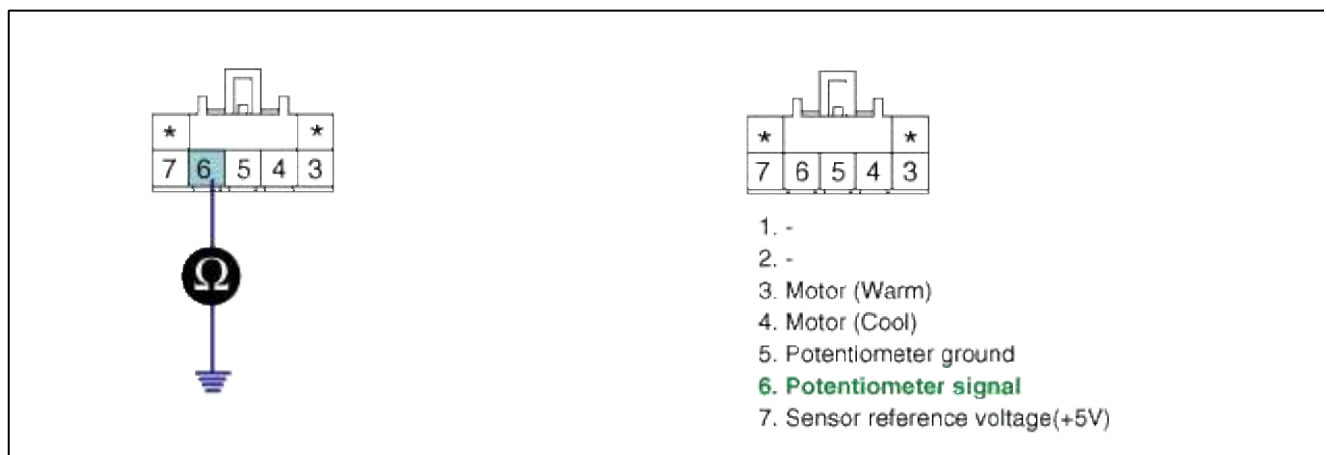
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix potentiometer.
- (3) Measure resistance between terminal "6" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx.  $\infty$   $\Omega$



(4) Is the measured resistance within specifications?

**YES**

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**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

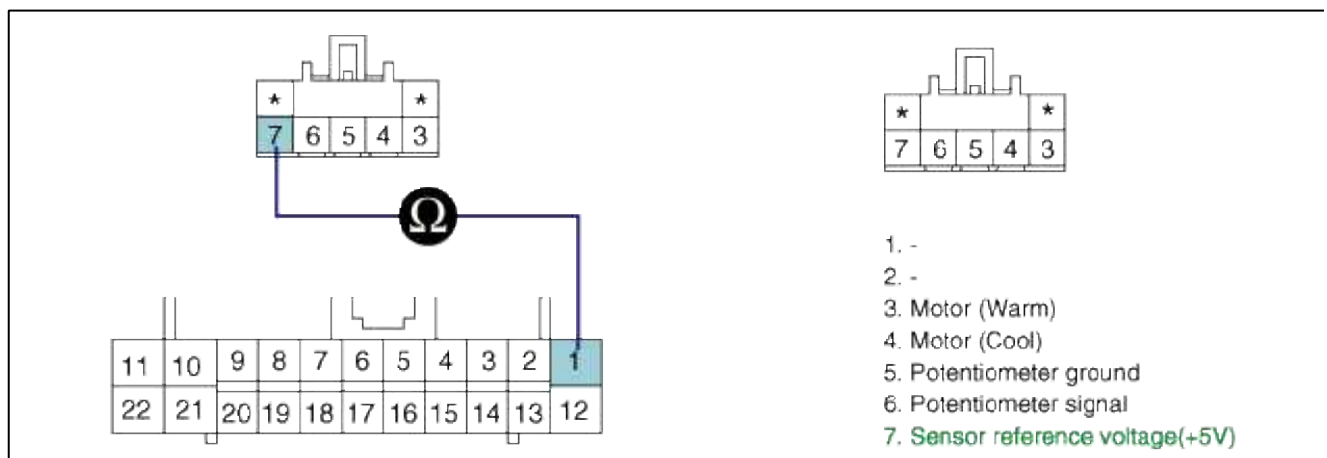
1. Check for open in harness.

(1) Ignition "ON"

(2) Connect Driver Air Mix Potentiometer.

(3) Measure resistance between terminal "3" of Driver Air Mix Potentiometer and terminal "1" of A/C control unit

Specification : 0Ω



(4) Is the measured voltage within specifications?

**YES**

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3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

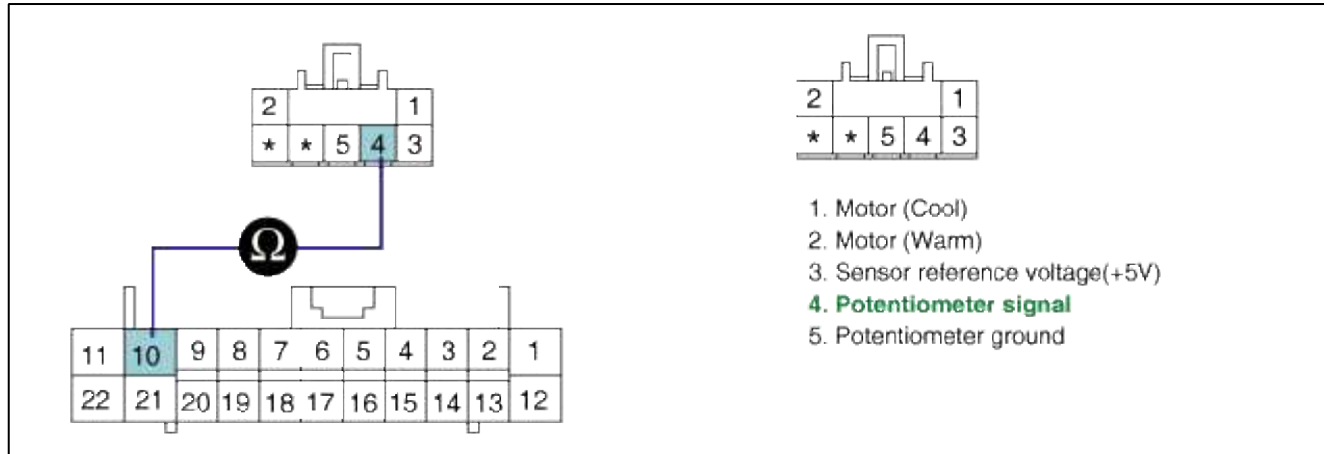
## SIGNAL CIRCUIT INSPECTION



## 1. Check for open in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix potentiometer.
- (3) Measure resistance between terminal "4" of Driver Air Mix Potentiometer and terminal "10" of A/C control un

Specification : Approx.  $0\ \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

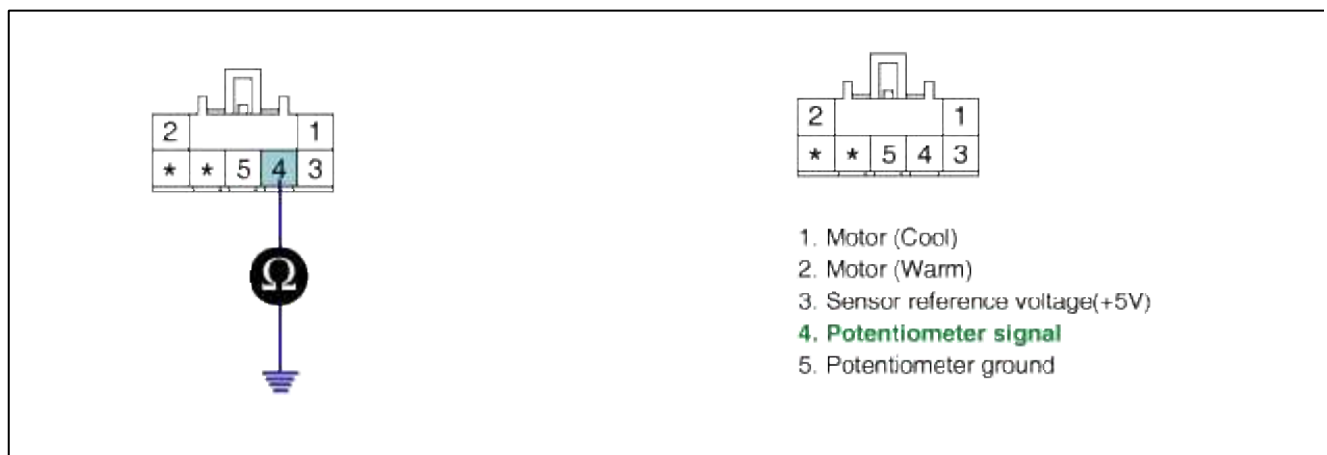
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix potentiometer.
- (3) Measure resistance between terminal "4" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx.  $\infty\ \Omega$



(4) Is the measured resistance within specifications?

**YES**

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**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

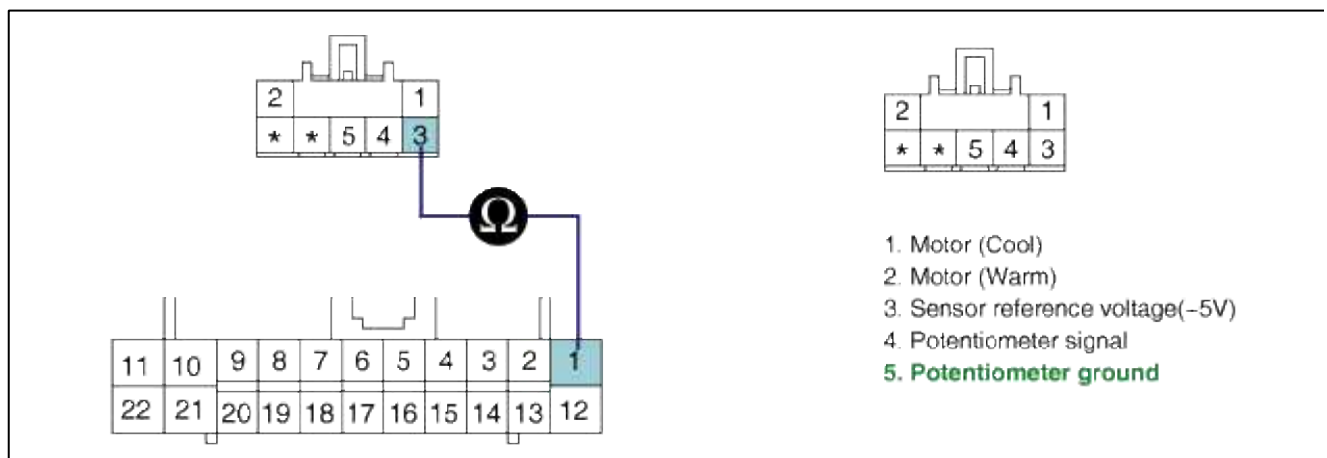
1. Check for open in harness.

(1) Ignition "ON"

(2) Connect Driver Air Mix Potentiometer.

(3) Measure resistance between terminal "3" of Driver Air Mix Potentiometer and terminal "1" of A/C control unit

Specification :  $0\Omega$



(4) Is the measured voltage within specifications?

**YES**

Go to "Component inspection" procedure.

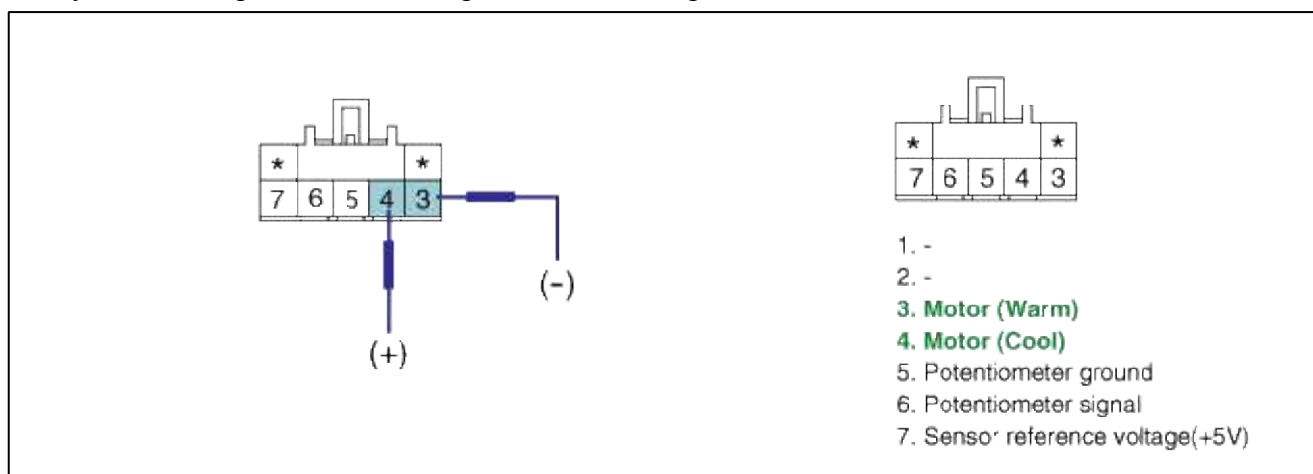
**NO**

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



## (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

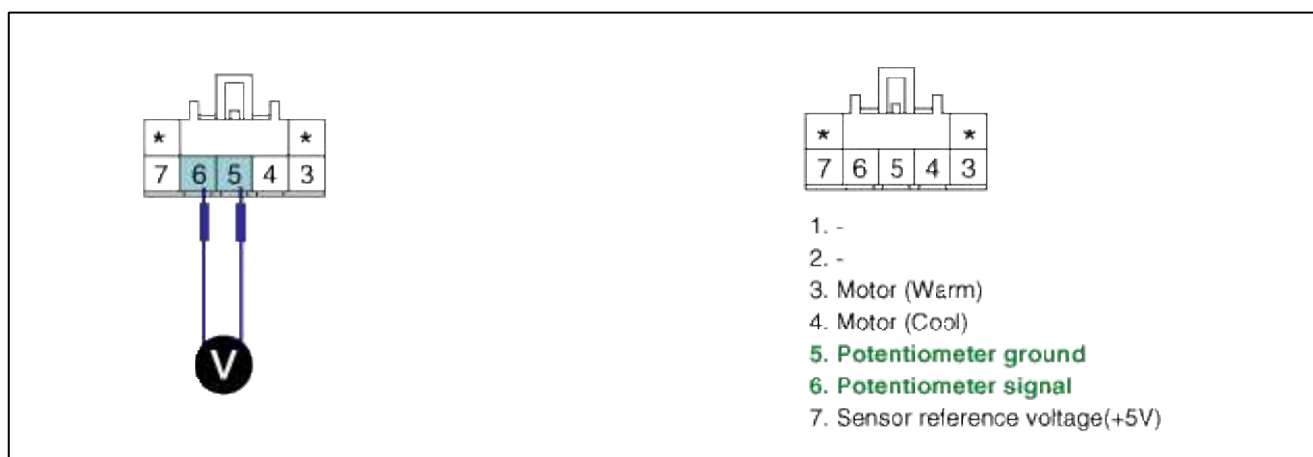
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Driver Air Mix potentiometer.
- (3) Measure voltage between terminal "6" and "5" of Driver Air Mix potentiometer while operating the temp. switch

Specification : Refer the specifications in fig 3)



Door position	Voltage (5-6)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more

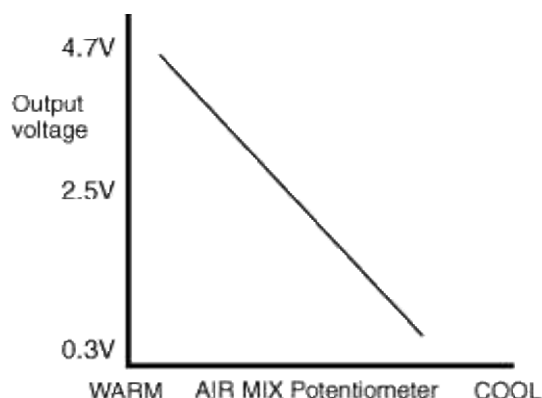
**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

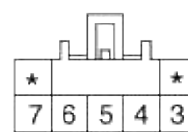
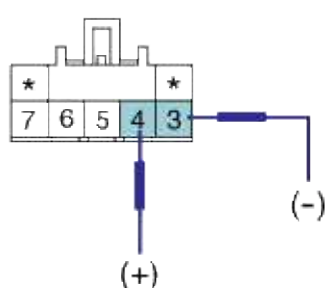
1. Check actuator motor.

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(2) Disconnect Driver Air Mix Potentiometer.

(3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".

(4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



- 1. -
- 2. -
- 3. **Motor (Warm)**
- 4. **Motor (Cool)**
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

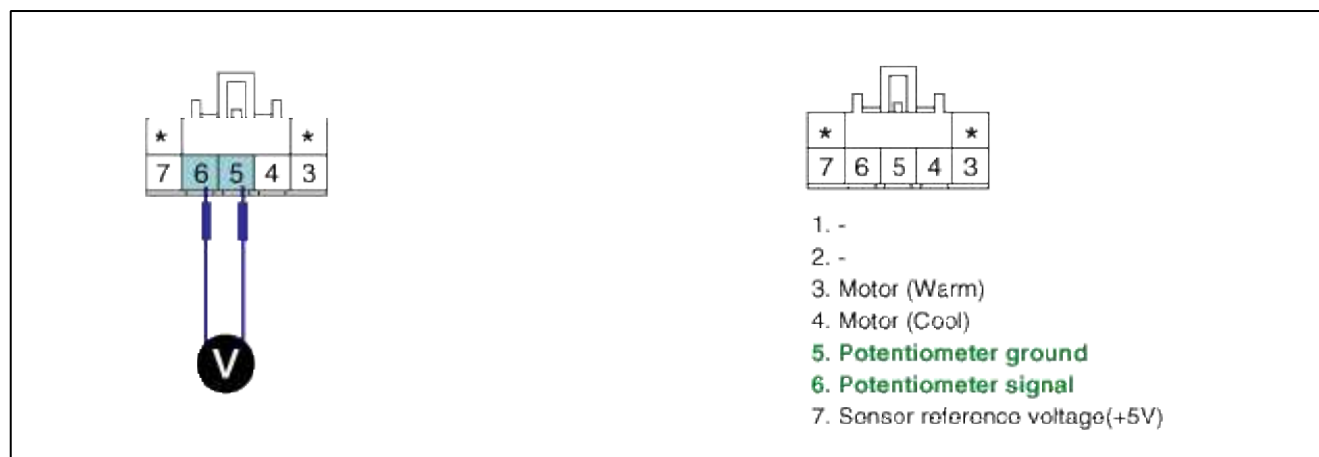
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace and then go to "Verification of Vehicle Repair" procedure.

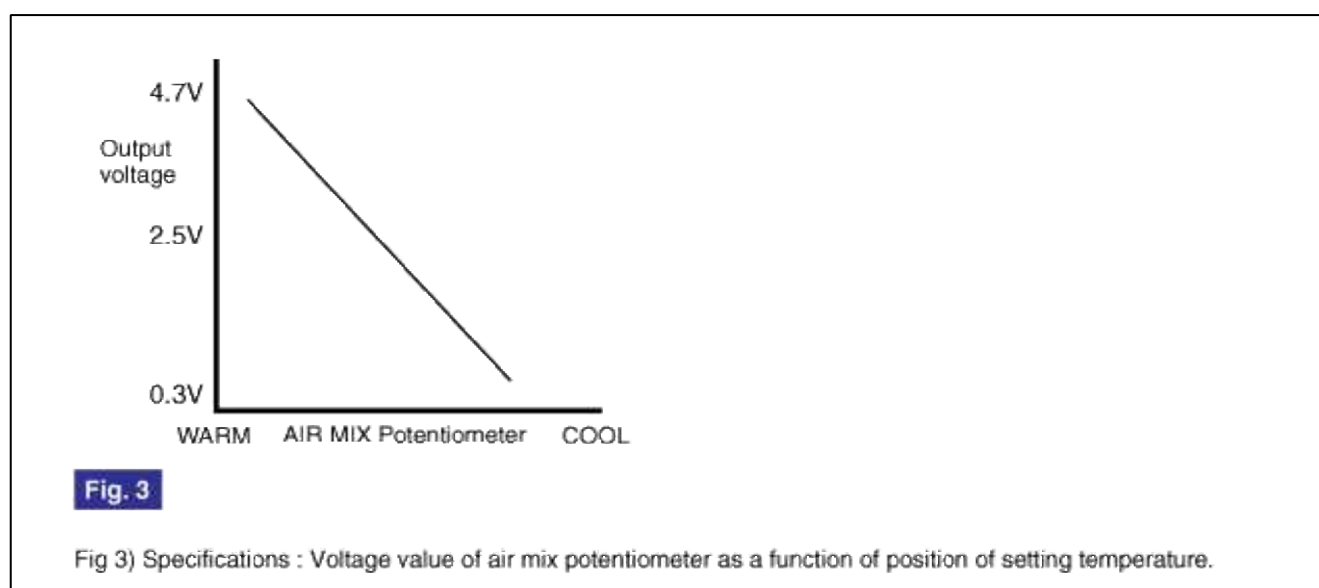
## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Driver Air Mix potentiometer.
- (3) Measure voltage between terminal "6" and "5" of Driver Air Mix potentiometer while operating the temp. switch

Specification : Refer the specifications in fig 3)



Door position	Voltage (5-6)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more



- (4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

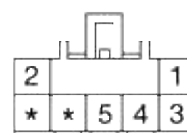
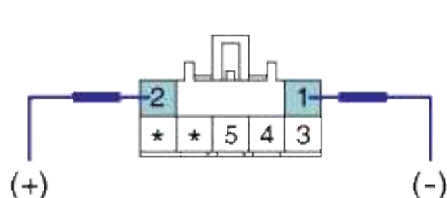
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "1" and grounding terminal "2".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



1. Motor (Cool)
2. Motor (Warm)
3. Sensor reference voltage(+5V)
4. Potent ometer signal
5. Potent ometer ground

## (5) Does the actuator work properly?

YES

Go to "Check potentiometer" procedure.

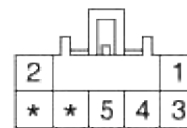
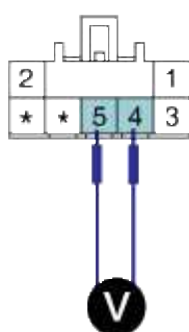
NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

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- (1) Ignition "ON"
- (2) Connect Driver Air Mix potentiometer.
- (3) Measure voltage between terminal "4" and "5" of Driver Air Mix potentiometer while operating the temp. swit

Specification : Refer the specifications in fig 3)



1. Motor (Cool)
2. Motor (Warm)
3. Sensor reference voltage(+5V)
4. Potentiometer signal
5. Potentiometer ground

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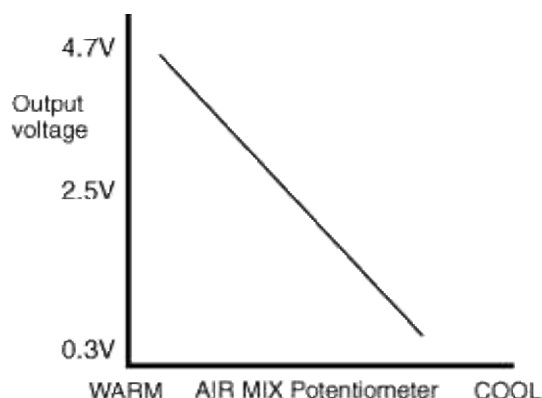
**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace it and then go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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3. Are any DTCs present?

**YES**

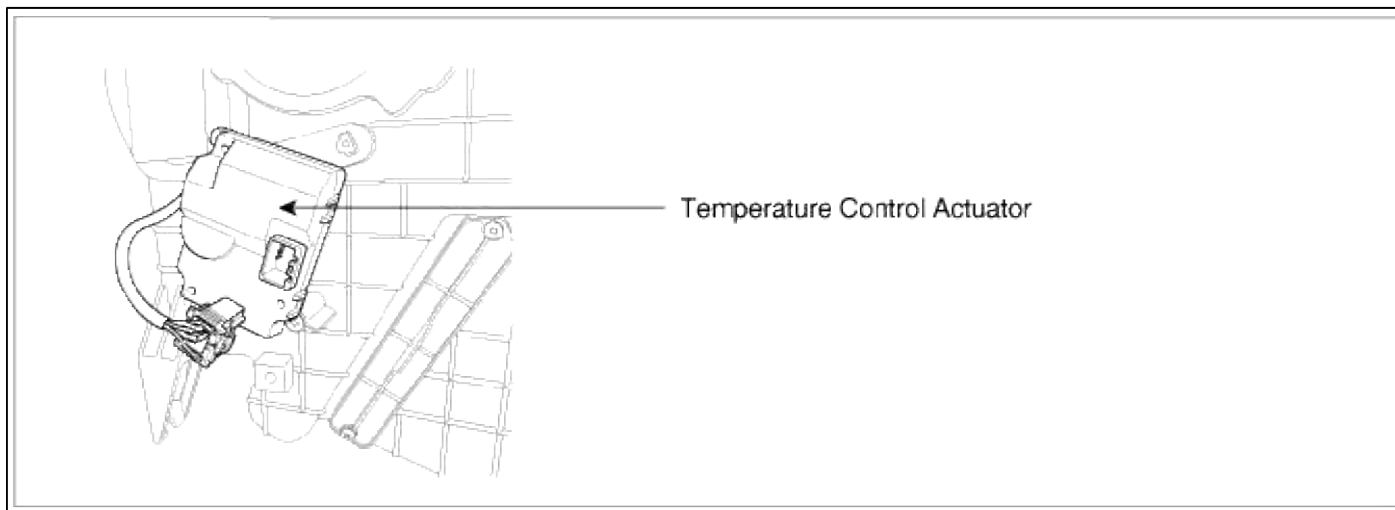
Go to the applicable troubleshooting procedure.

**NO**

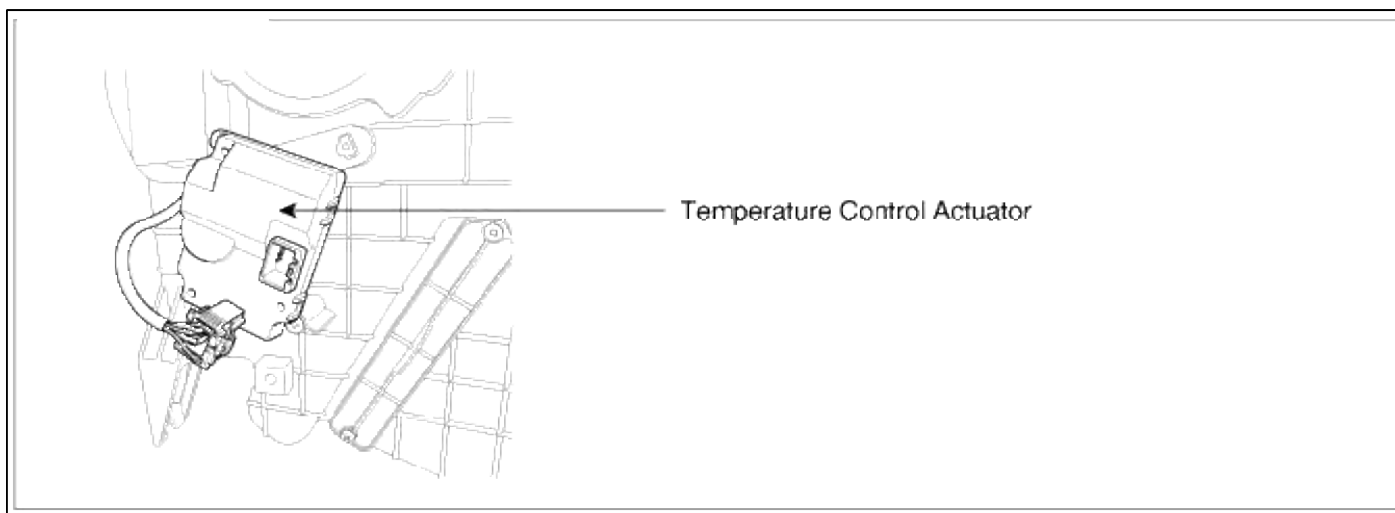
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1246

#### COMPONENT LOCATION

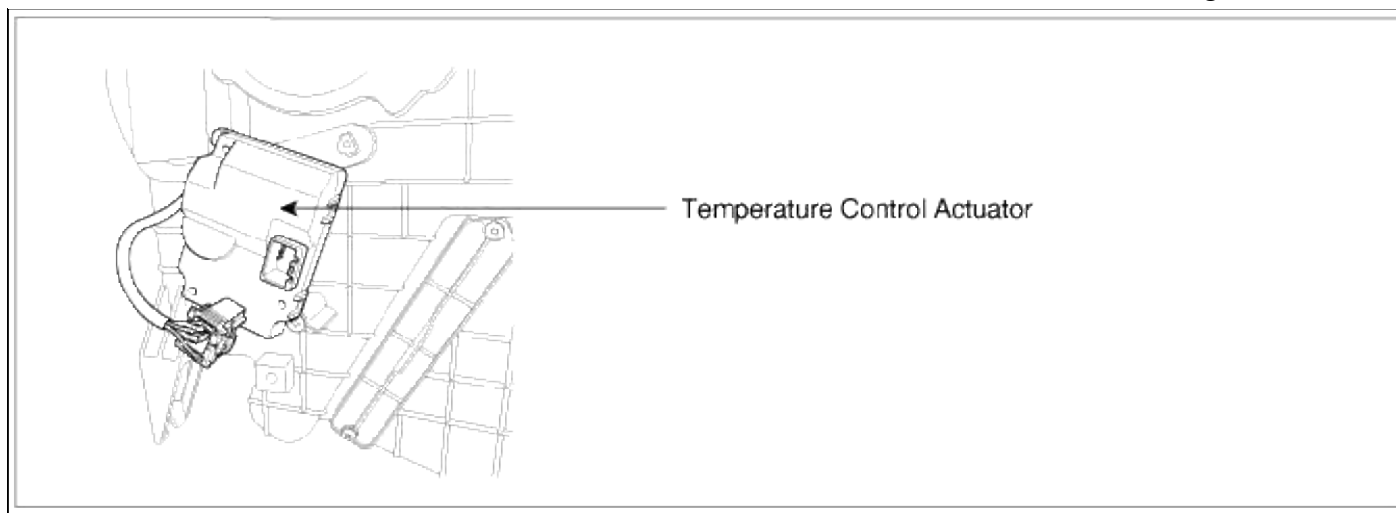


#### COMPONENT LOCATION



#### COMPONENT LOCATION





### GENERAL DESCRIPTION

Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

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### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> </ul>
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• If temperature setting 17~24.5°C(63~76°F) fix at max. cooling position.</li> <li>• If temperature setting 25~32°C(77~90°F) fix at max. heating position.</li> </ul>	

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#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Driver Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	13.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	12.5 °C	■
DRIVER PHOTO SENSOR	0.00 V	
AIR MIX POPENTIO.	91.75 %	
DIRECTION POTENIO.DR.	90.18 %	
PASSENGER PHOTO SENSOR	255	▼
FIX	SCRN	FULL
PART	GRPH	HELP

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES		
B1246 AIR MIX P. - HIGH INPUT		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	HELP

**Fig. 2**

Fig 2 : DTC B1246.

## 4. Are the DTC B1246 present and is parameter of "Driver Air Mix potentiometer" fixed?

Parameter of "Driver Air Mix potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Air Mix potentiometer.

☐ YES

Go to "Inspection" procedure.

☐ NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

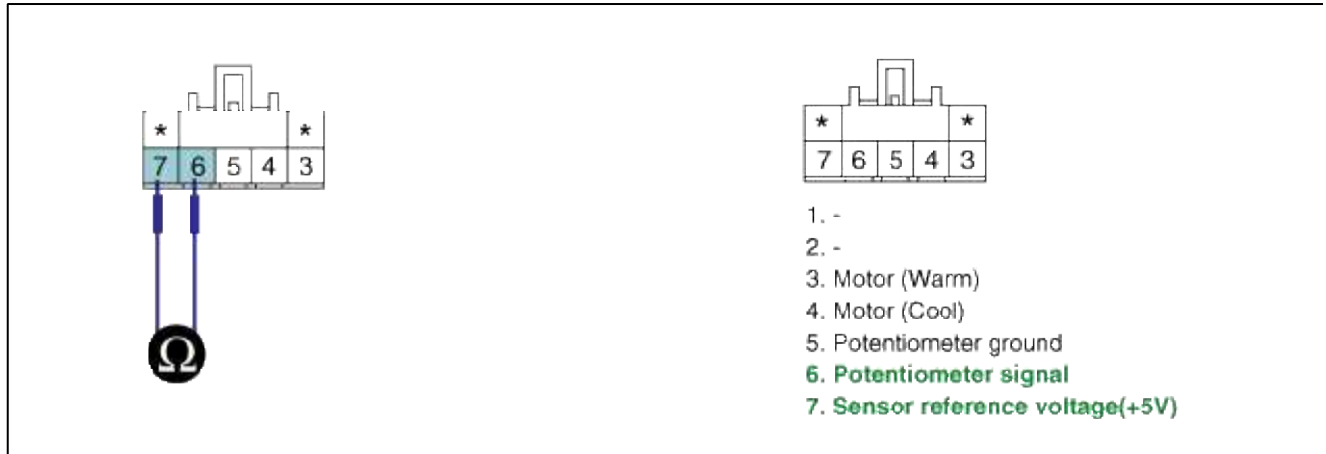
**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Driver Air Mix potentiometer.
  - (3) Measure resistance between terminal "6" and "7" of Driver Air Mix potentiometer.

Specification : Approx.  $\infty \Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

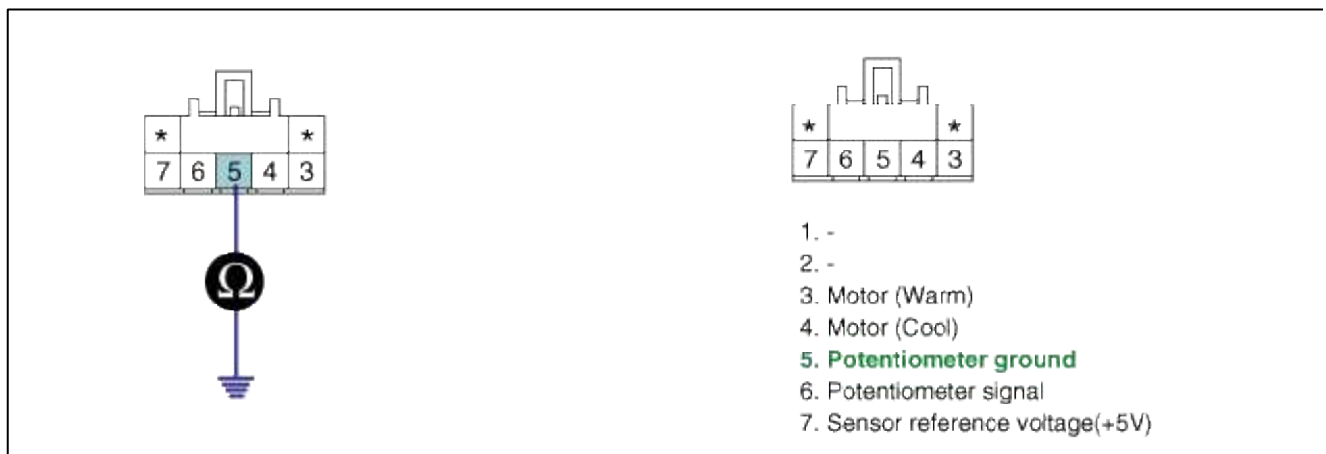
**NO**

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Rep procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Driver Air Mix Potentiometer.
  - (3) Measure resistance between terminal "5" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx.  $0 \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

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**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

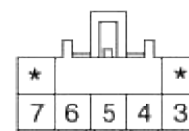
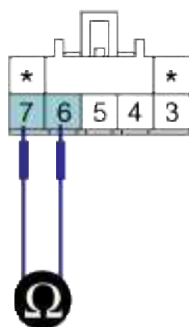
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(2) Disconnect Driver Air Mix potentiometer.

(3) Measure resistance between terminal "6" and "7" of Driver Air Mix potentiometer.

Specification : Approx.  $\infty \Omega$



- 1. -
- 2. -
- 3. Motor (Warm)
- 4. Motor (Cool)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

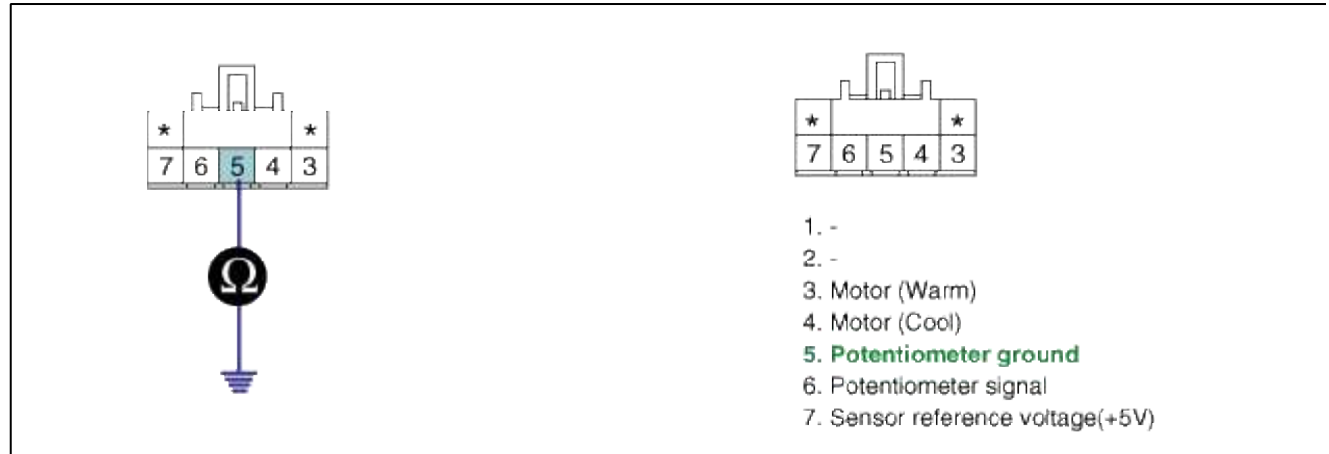
**NO**

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Driver Air Mix Potentiometer.
  - (3) Measure resistance between terminal "5" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

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3. Has a problem been found?

**YES**

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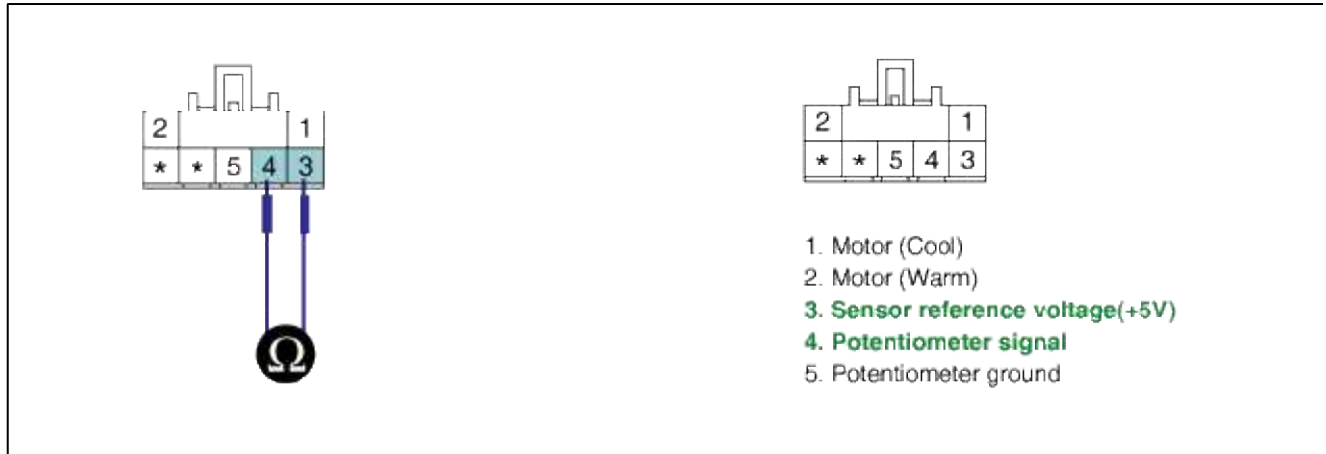
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Driver Air Mix potentiometer.
  - (3) Measure resistance between terminal "3" and "4" of Driver Air Mix potentiometer.

Specification : Approx.  $\infty \Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit Inspection" procedure.

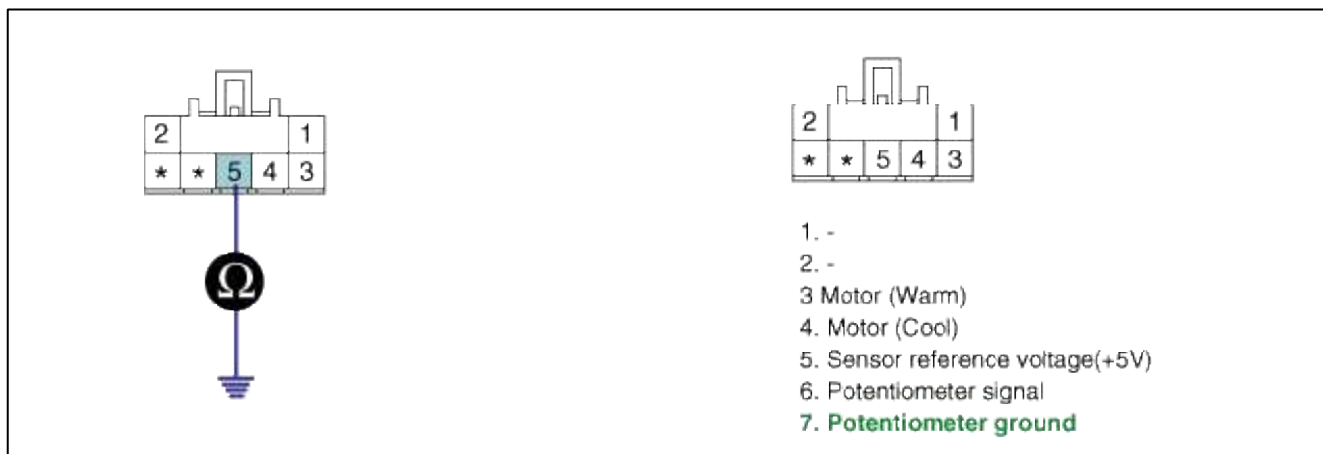
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## GROUND CIRCUIT INSPECTION

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(4) Is the measured resistance within specifications?

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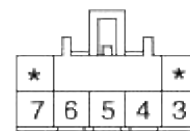
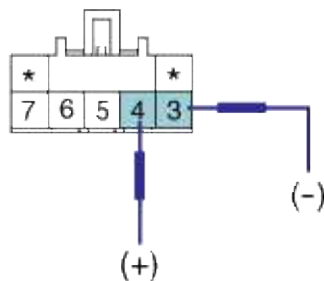
1. Check actuator motor.

(1) Ignition "OFF"

(2) Disconnect Driver Air Mix Potentiometer.

(3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".

(4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



- 1. -
- 2. -
- 3. **Motor (Warm)**
- 4. **Motor (Cool)**
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

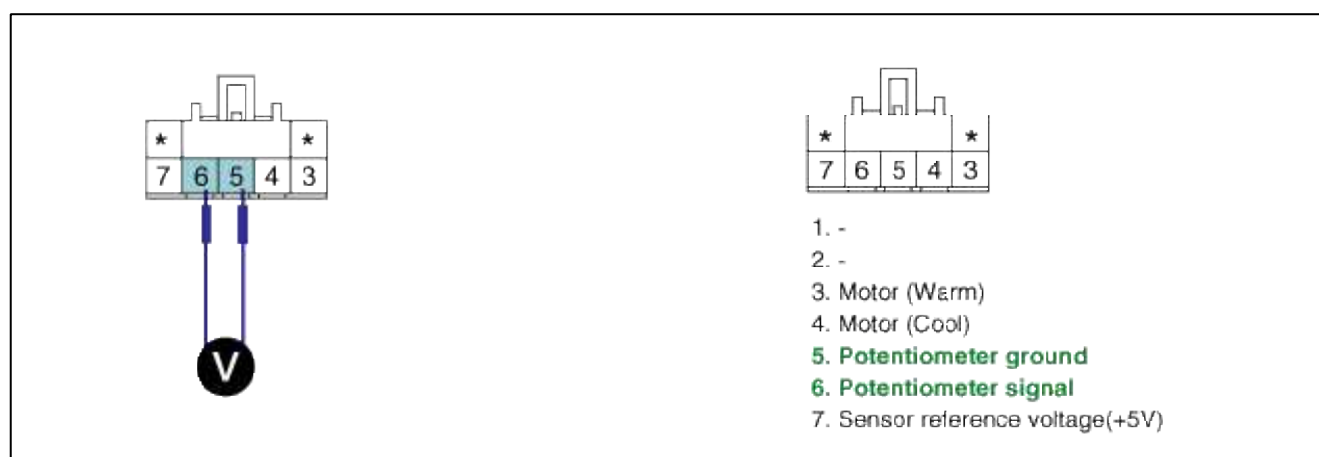
2. Check potentiometer

(1) Ignition "ON"

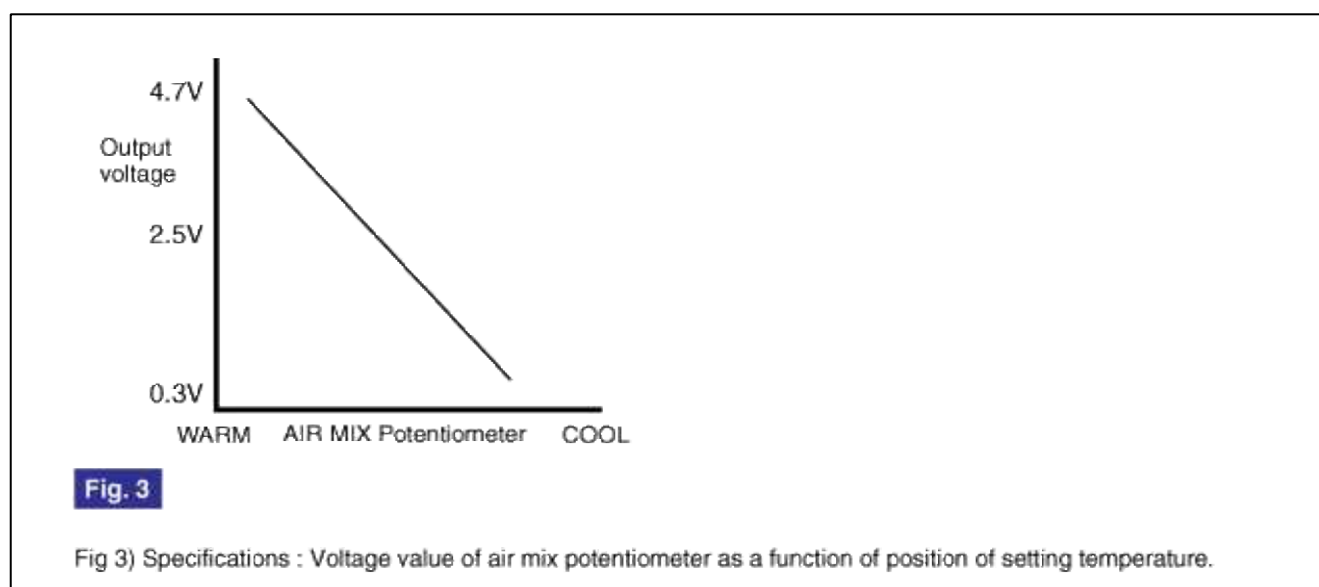
(2) Connect Driver Air Mix potentiometer.

(3) Measure voltage between terminal "4" and "5" of Driver Air Mix potentiometer while operating the temp. switch

Specification : Refer the specifications in fig 3)



Door position	Voltage (5-6)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more



(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

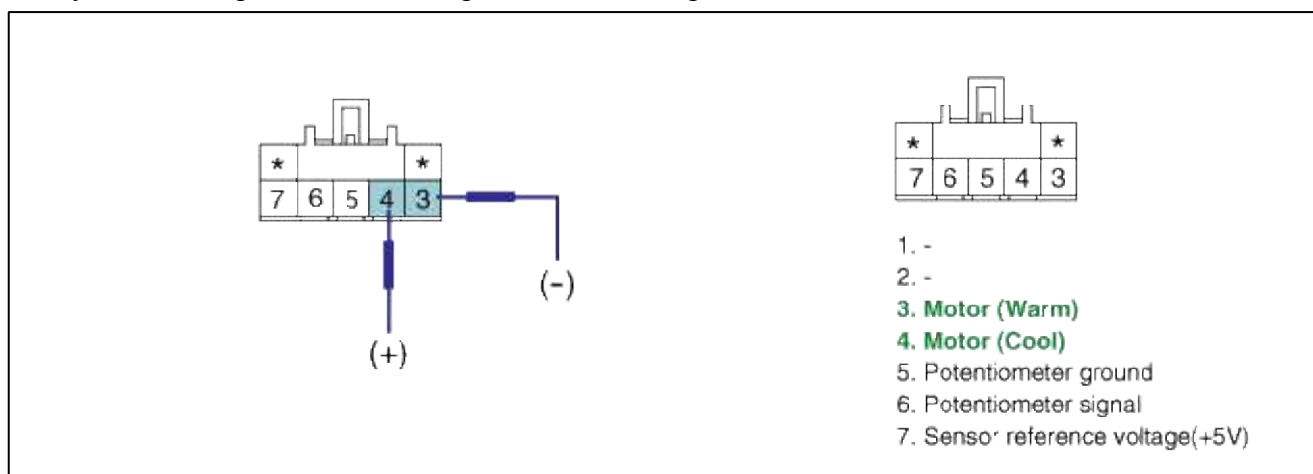
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## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



## (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

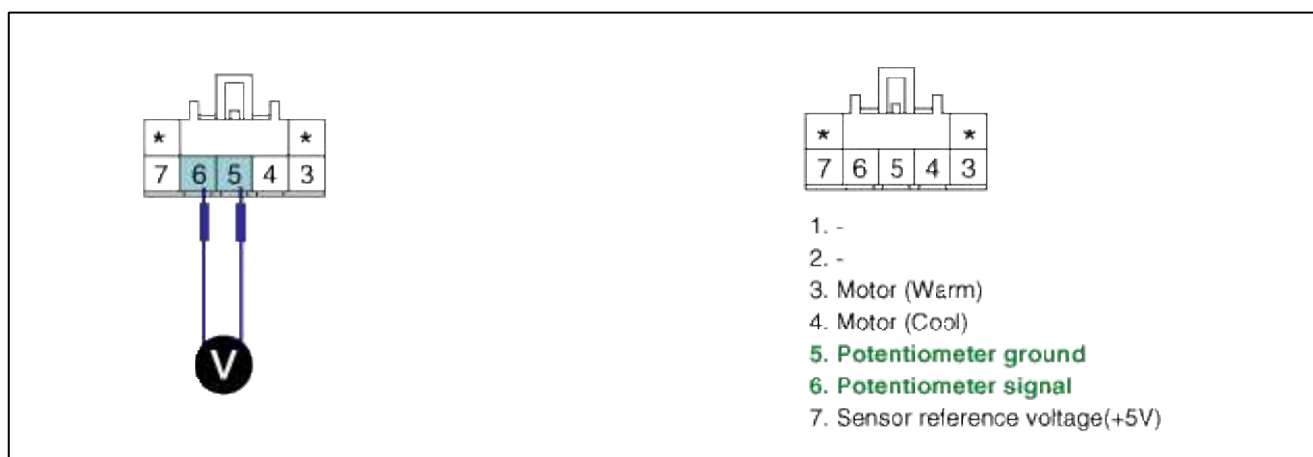
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Driver Air Mix potentiometer.
- (3) Measure voltage between terminal "4" and "5" of Driver Air Mix potentiometer while operating the temp. switch

Specification : Refer the specifications in fig 3)



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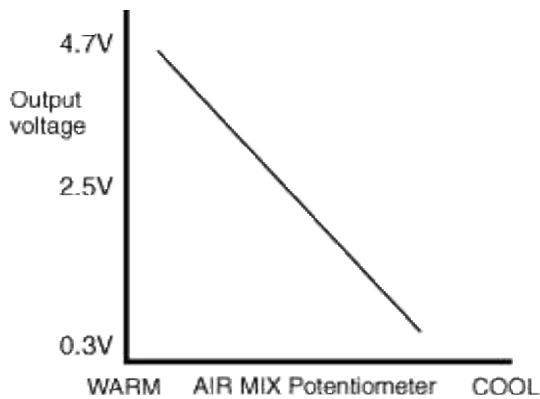
**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

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## COMPONENT INSPECTION

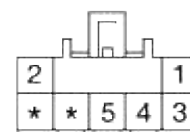
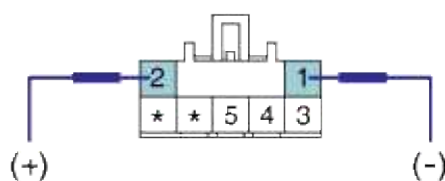
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(2) Disconnect Driver Air Mix Potentiometer.

(3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "1" and grounding terminal "2".

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- 1. Motor (Cool)
- 2. Motor (Warm)
- 3. Sensor reference voltage(+5V)
- 4. Potent ometer signal
- 5. Potent ometer ground

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

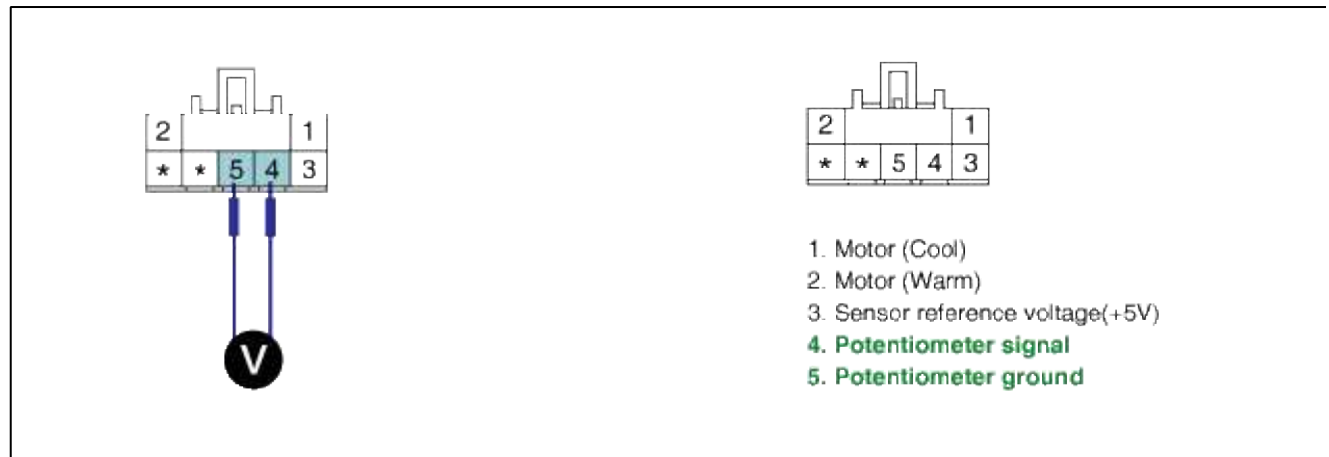
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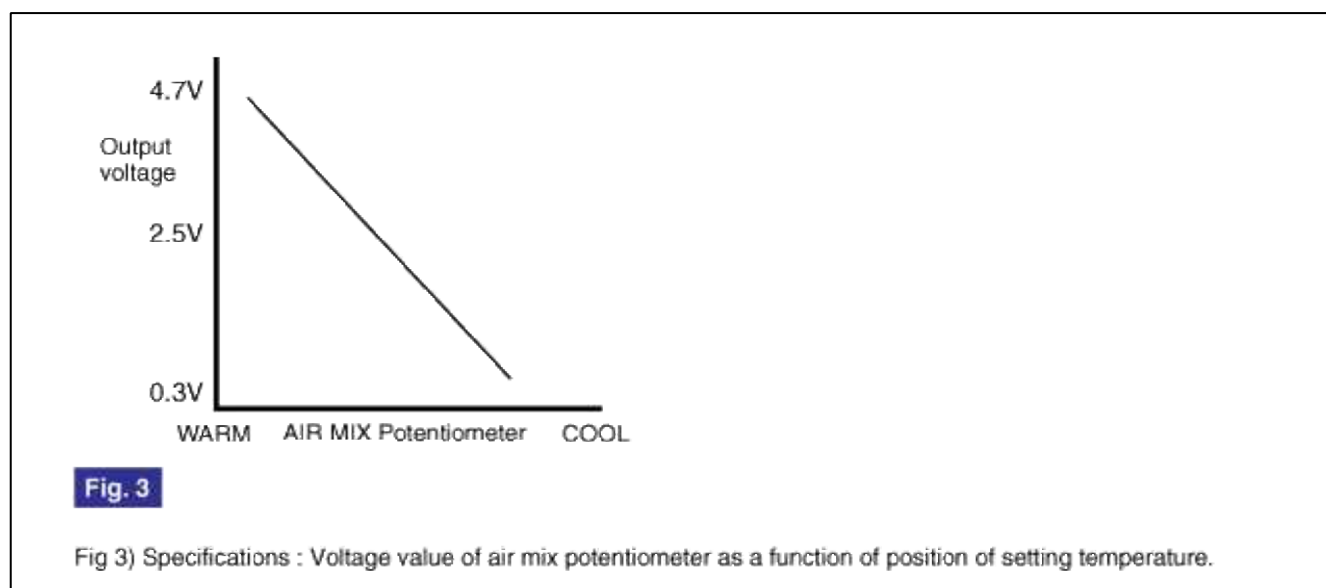
## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Driver Air Mix potentiometer.
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**NO**

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## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

☐ YES

Go to the applicable troubleshooting procedure.

☐ NO

System is performing to specification at this time.

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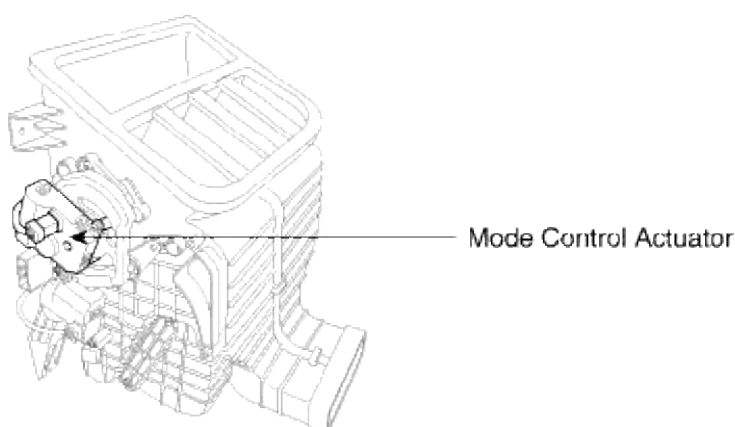
Go to the applicable troubleshooting procedure.

☐ NO

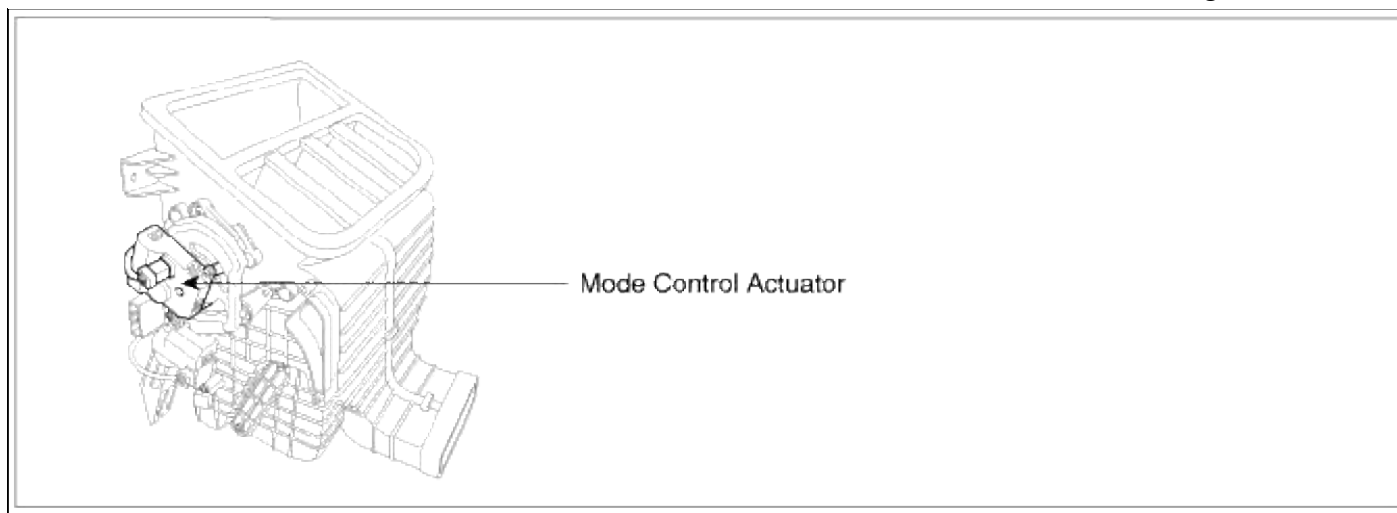
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1249

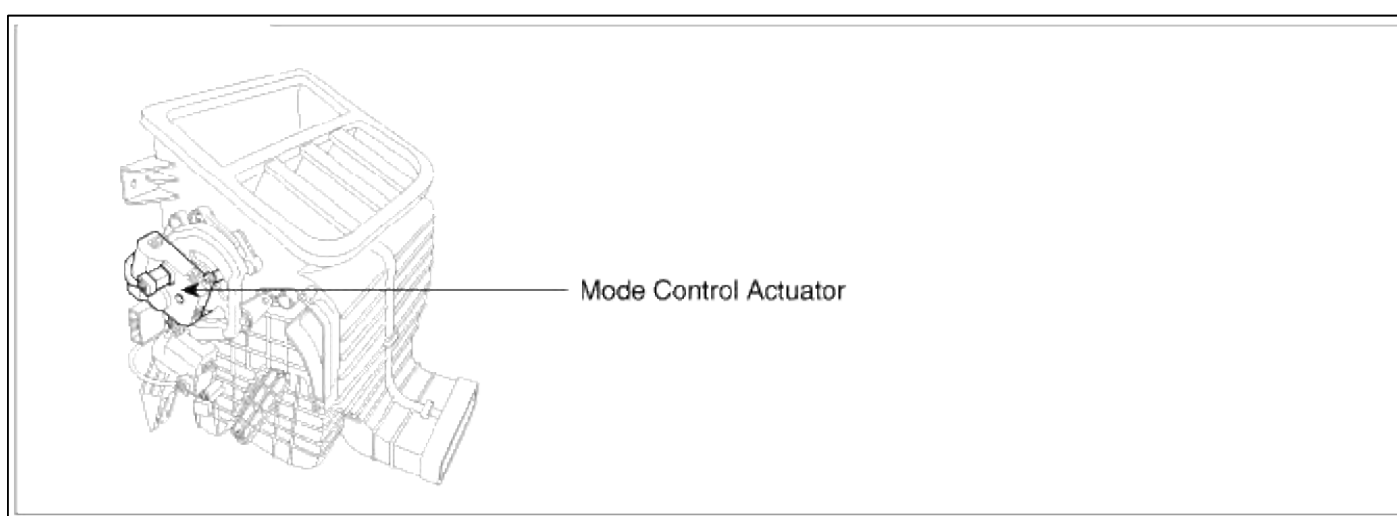
#### COMPONENT LOCATION



#### COMPONENT LOCATION



## COMPONENT LOCATION



## GENERAL DESCRIPTION

The mode control actuator mounted on heater unit, adjusts position of mode door by operating Direction Motor based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent → B/L → floor → mix.

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## DTC DESCRIPTION

The A/C controller sets DTC B1249 if there is an open circuit or poor connection in the Direction potentiometer.

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## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver direction potentiometer</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• Fix vent position, while selecting vent mode.</li> <li>• Fix defrost position while selecting except vent mode.</li> </ul>	

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver direction potentiometer</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• Fix vent position, while selecting vent mode.</li> <li>• Fix defrost position while selecting except vent mode.</li> </ul>	

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Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	<ul style="list-style-type: none"> <li>• Fix vent position, while selecting vent mode.</li> <li>• Fix defrost position while selecting except vent mode.</li> </ul>	

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"



3. Monitor the "DIRECTION POTENTIO." parameter on the scantool while operating mode switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	13.0 °C
IN-CAR TEMP.SENSOR	11.5 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENATIO.(DR.)	92.54 %
<b>DIRECTION POTENIO</b>	<b>1.96 %</b>
PASSENGER PHOTO SENSOR	255

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1249.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B1249 DIRECTION P. - LOW INPUT</b>	
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
HELP	

Fig. 2

4. Are the DTC B1249 present and is parameter of "DR. DIRECTION POTENTIO." fixed?

Parameter of "DR. DIRECTION POTENTIO." will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Direction potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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Fig. 2

## 4. Are the DTC B1249 present and is parameter of "DR. DIRECTION POTENTIO." fixed?

Parameter of "DR. DIRECTION POTENTIO." will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Direction potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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1.1 DIAGNOSTIC TROUBLE CODES
<b>B1249 DIRECTION P. - LOW INPUT</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

## 4. Are the DTC B1249 present and is parameter of "DR. DIRECTION POTENTIO." fixed?

Parameter of "DR. DIRECTION POTENTIO." will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Direction potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

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### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

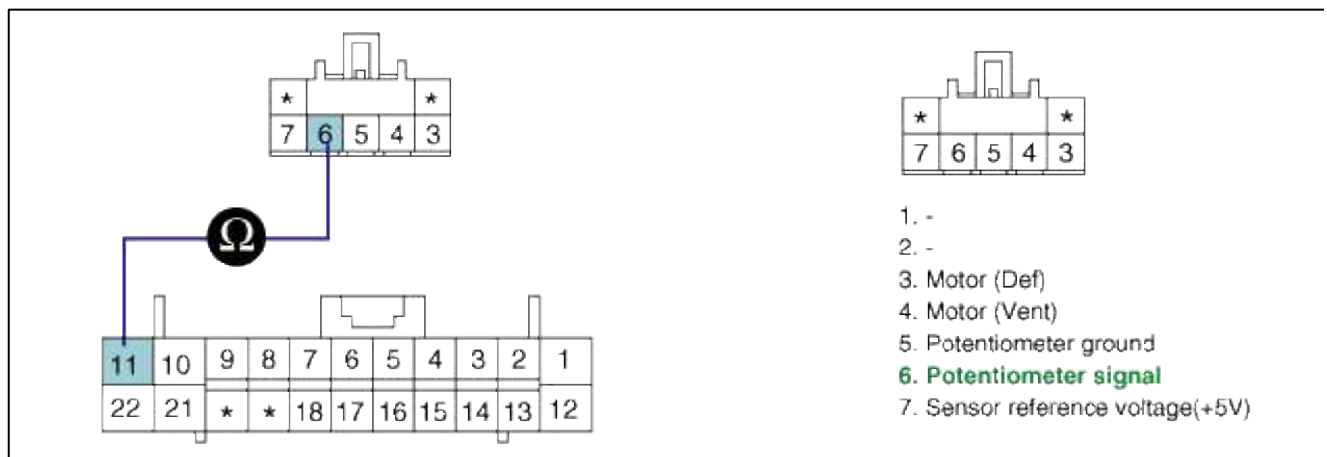
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "6" of Direction potentiometer and terminal "11" of A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

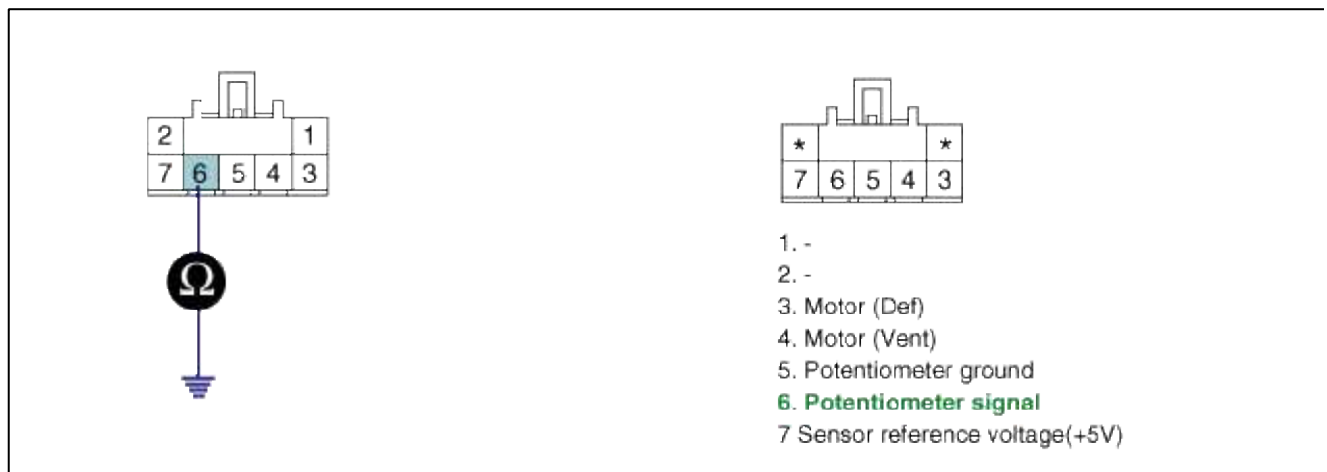
2. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "6" of Direction potentiometer and chassis ground.

Specification : Approx.  $\infty \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

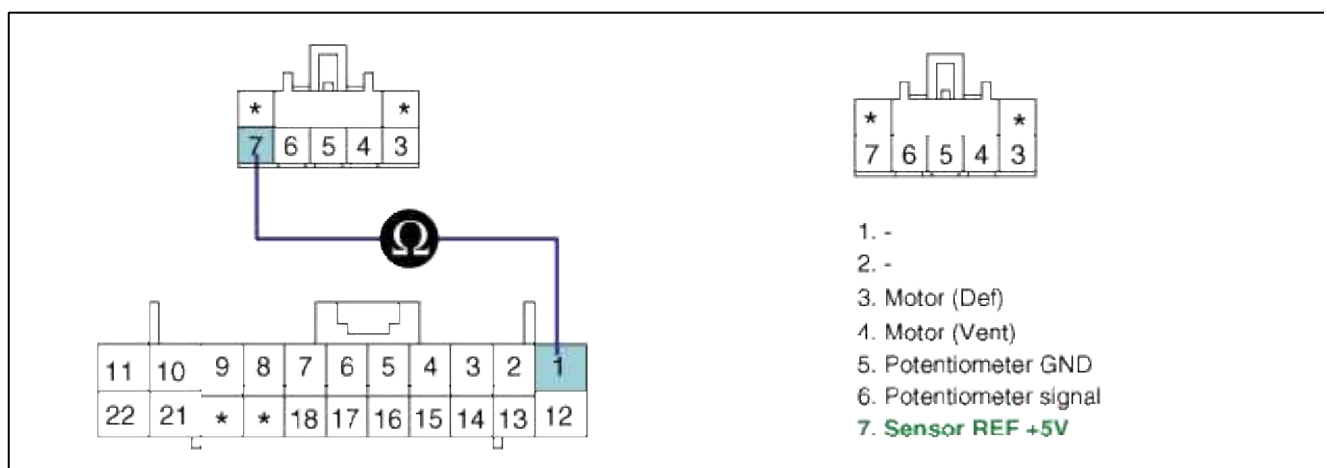
1. Check for open in harness.

(1) Ignition "ON"

(2) Connect Direction potentiometer.

(3) Measure resistance between terminal "7" of Direction potentiometer and terminal "1" of A/C control unit.

Specification : Approx. 5V



(4) Is the measured voltage within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

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**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

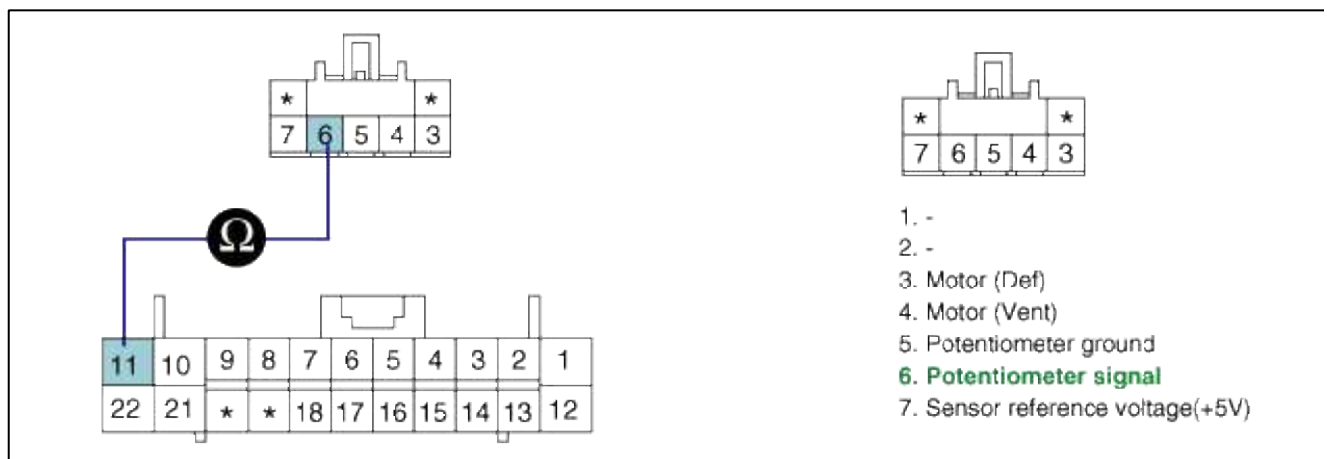
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "6" of Direction potentiometer and terminal "11" of A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

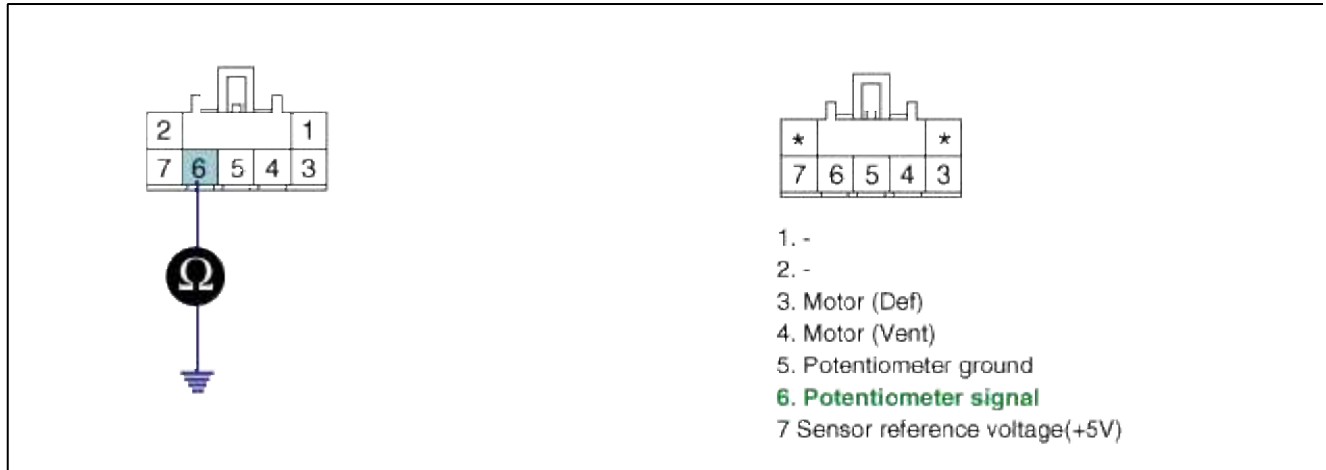
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect mode Actuator.
- (3) Measure resistance between terminal "6" of Direction potentiometer and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

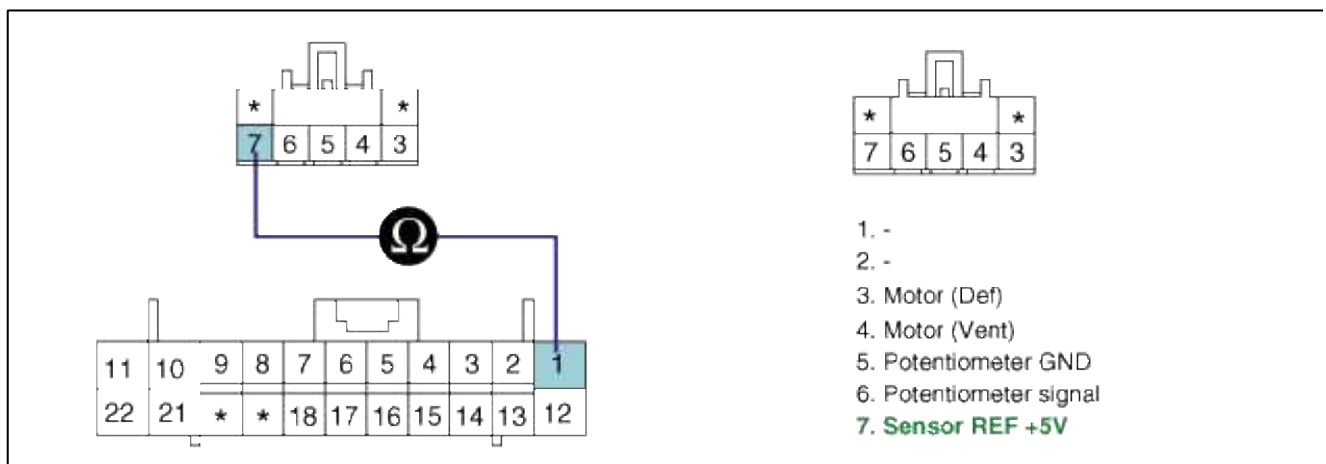
Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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**YES**

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**NO**

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## SIGNAL CIRCUIT INSPECTION

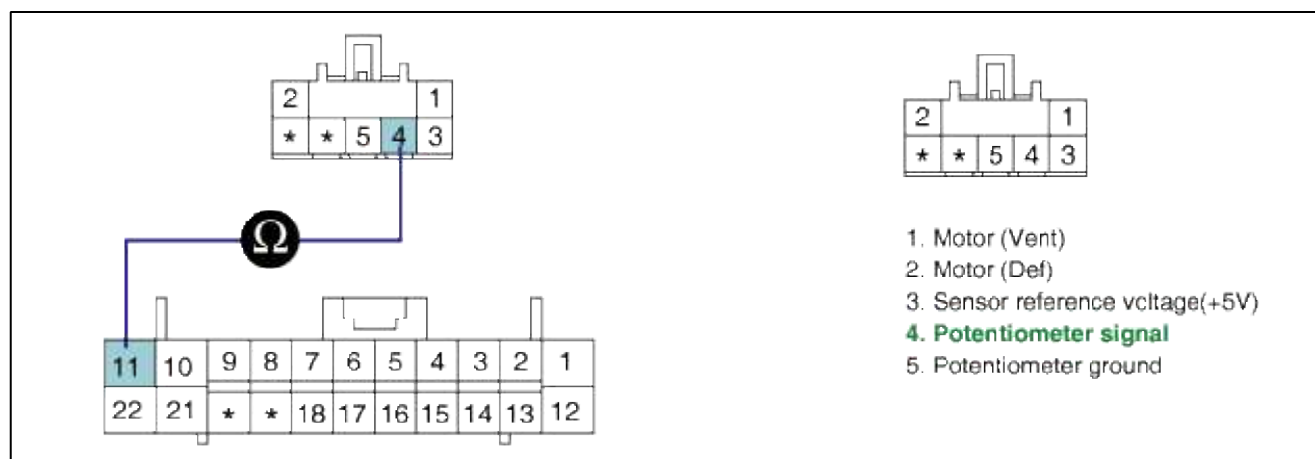
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "4" of Direction potentiometer and terminal "11" of A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

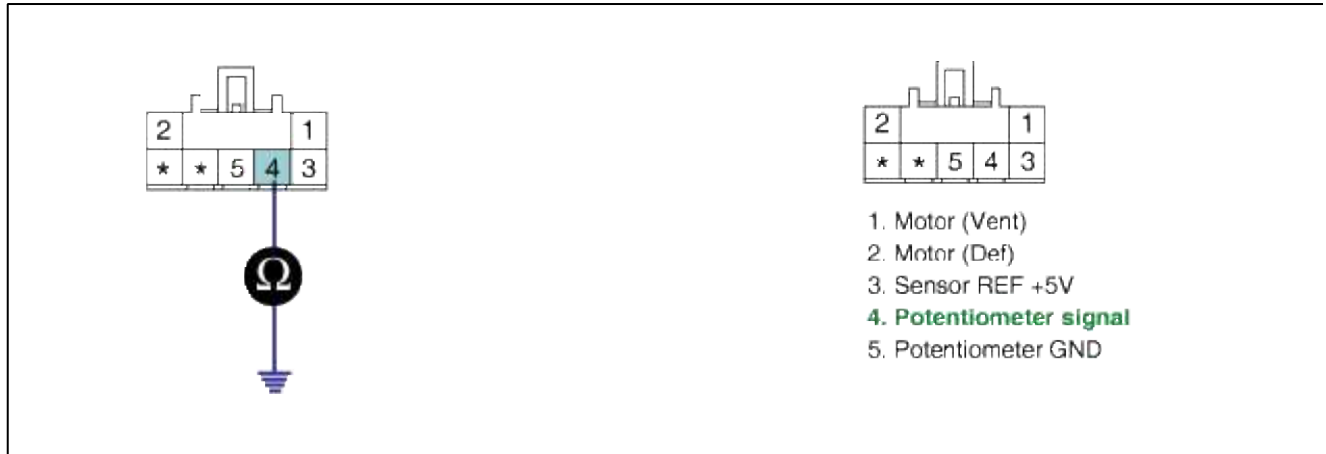
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect mode Actuator.
- (3) Measure resistance between terminal "4" of Direction potentiometer and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Power circuit Inspection" procedure.

**NO**

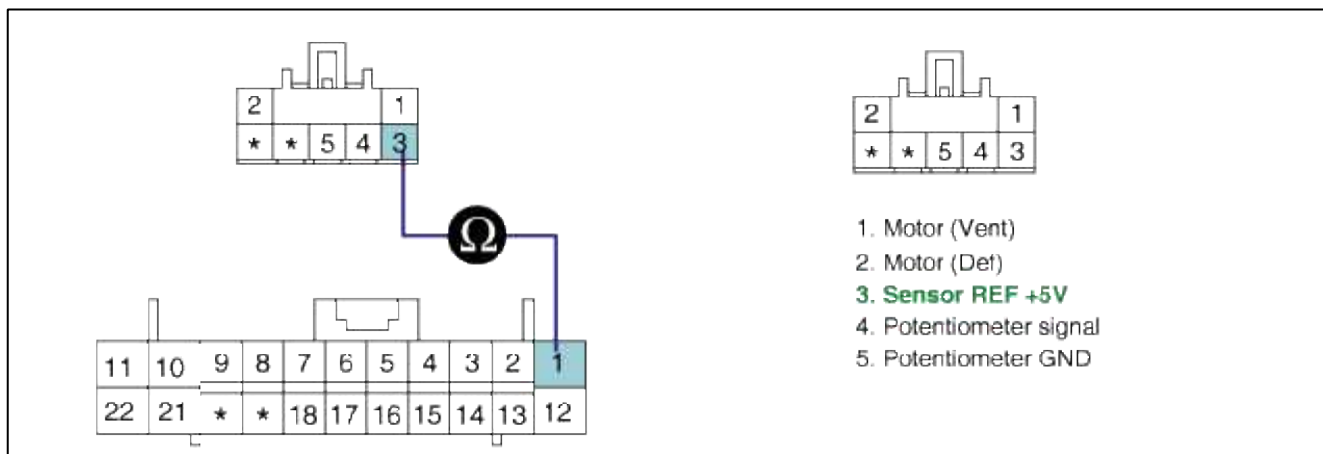
Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## POWER SUPPLY CIRCUIT INSPECTION

## 1. Check for open in harness.

- (1) Ignition "ON"
- (2) Connect Direction potentiometer.
- (3) Measure resistance between terminal "3" of Direction potentiometer and terminal "1" of A/C control unit.

Specification : Approx. 5V





(4) Is the measured voltage within specifications?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

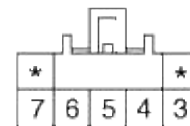
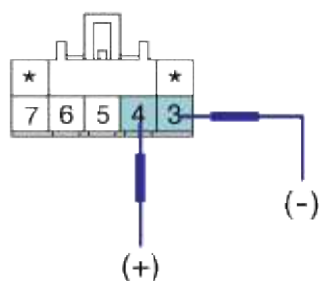
1. Check actuator.

(1) Ignition "OFF"

(2) Disconnect Direction potentiometer.

(3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal "3" and ground terminal "4".

(4) Verify that the mode actuator operates to the def mode when the connections are reversed.



- 1. -
- 2. -
- 3. **Motor (Def)**
- 4. **Motor (Vent)**
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

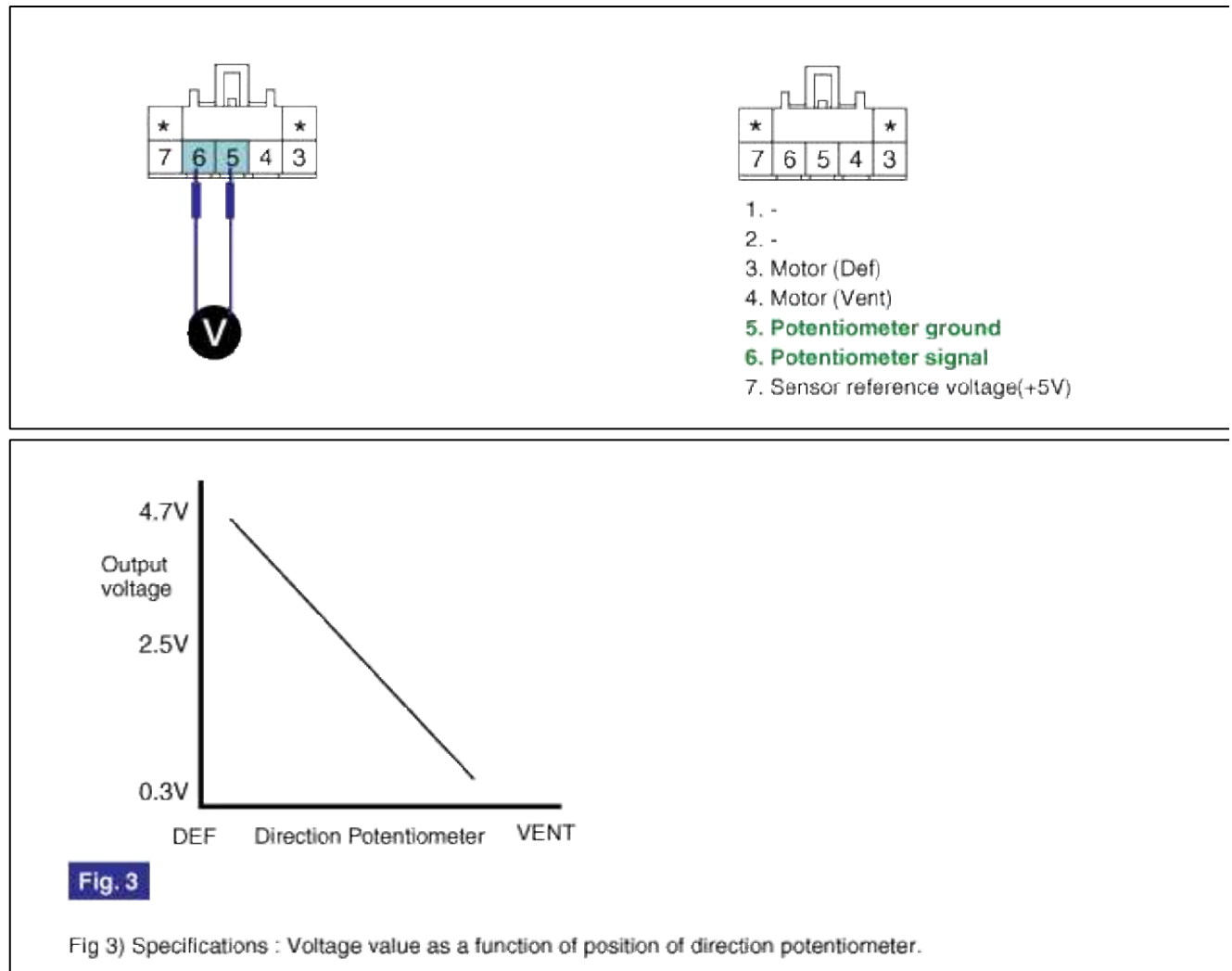
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Direction potentiometer.
- (3) Measure voltage between terminal "5" and "6" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



- (4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

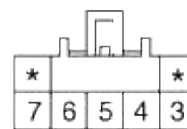
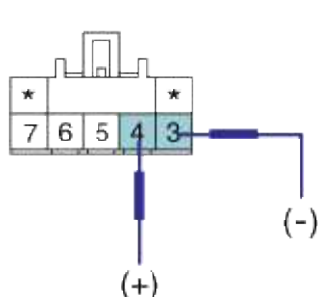
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator.

- (1) Ignition "OFF"
- (2) Disconnect Direction potentiometer.
- (3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal "3" and ground terminal "4".
- (4) Verify that the mode actuator operates to the def mode when the connections are reversed.



1. -
2. -
3. **Motor (Def)**
4. **Motor (Vent)**
5. Potentiometer ground
6. Potentiometer signal
7. Sensor reference voltage(+5V)

## (5) Does the actuator work properly?

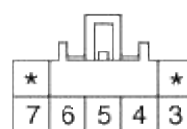
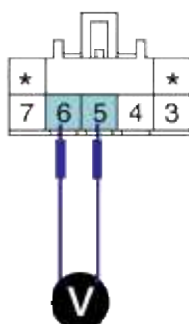
Go to "Check potentiometer" procedure.

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Direction potentiometer.
- (3) Measure voltage between terminal "5" and "6" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



1. -
2. -
3. Motor (Def)
4. Motor (Vent)
5. **Potentiometer ground**
6. **Potentiometer signal**
7. Sensor reference voltage(+5V)

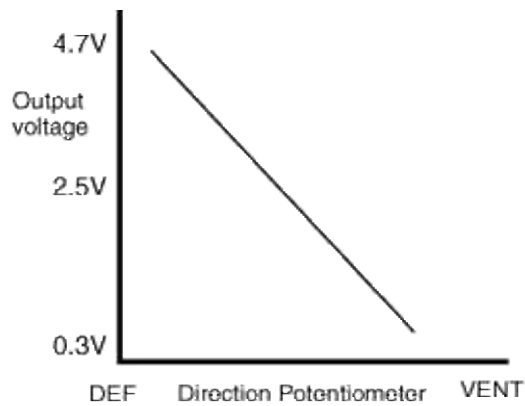
**Fig. 3**

Fig 3) Specifications : Voltage value as a function of position of direction potentiometer.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

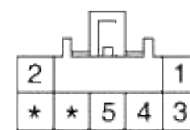
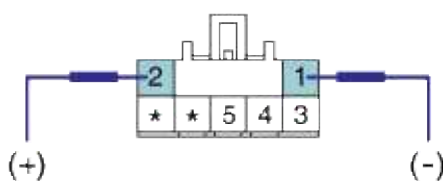
1. Check actuator.

(1) Ignition "OFF"

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- 1. Motor (Vent)
- 2. Motor (Def)
- 3. Sensor reference voltage(+5V)
- 4. Potentiometer signal
- 5. Potentiometer ground

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

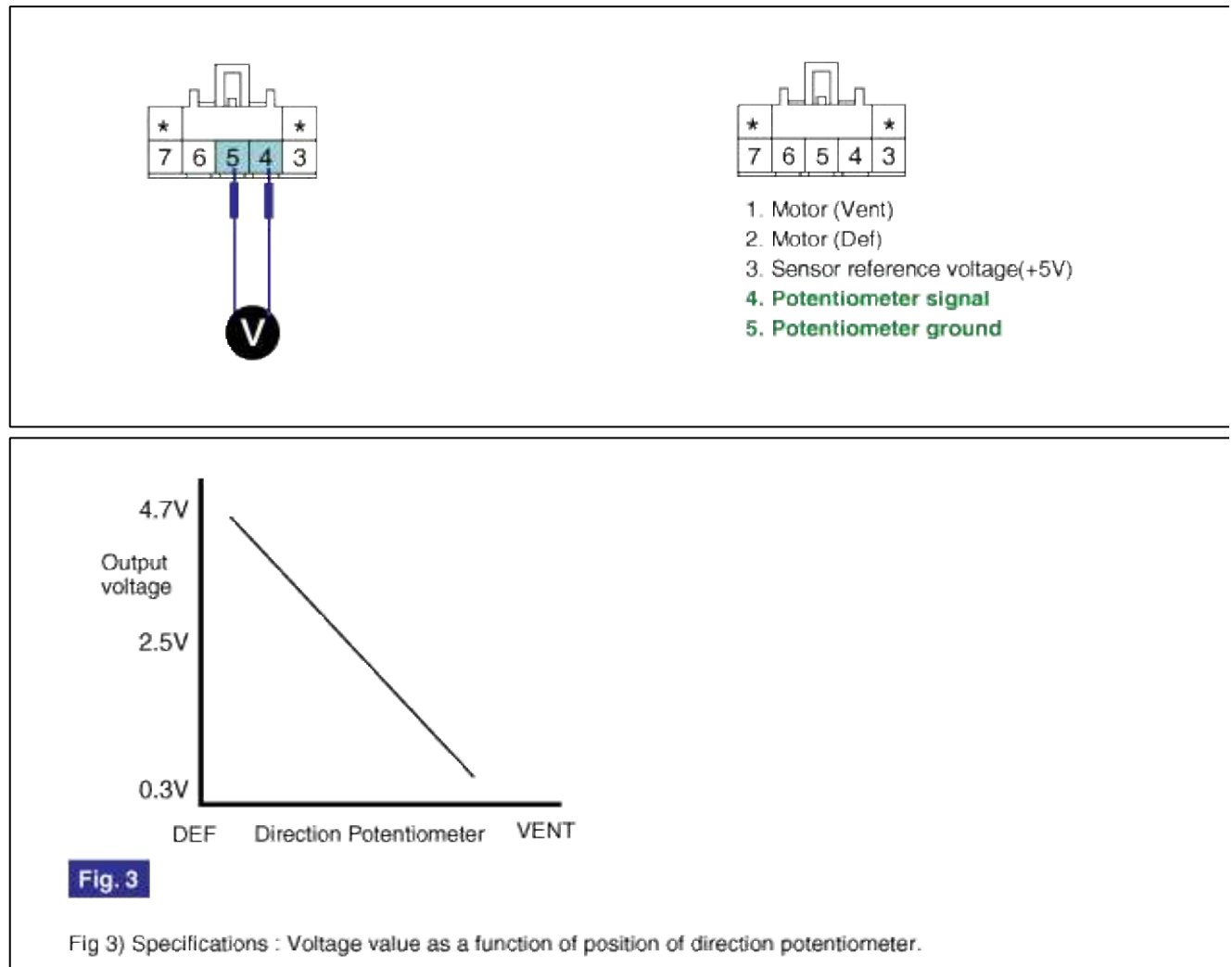
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Direction potentiometer.
- (3) Measure voltage between terminal "4" and "5" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.

3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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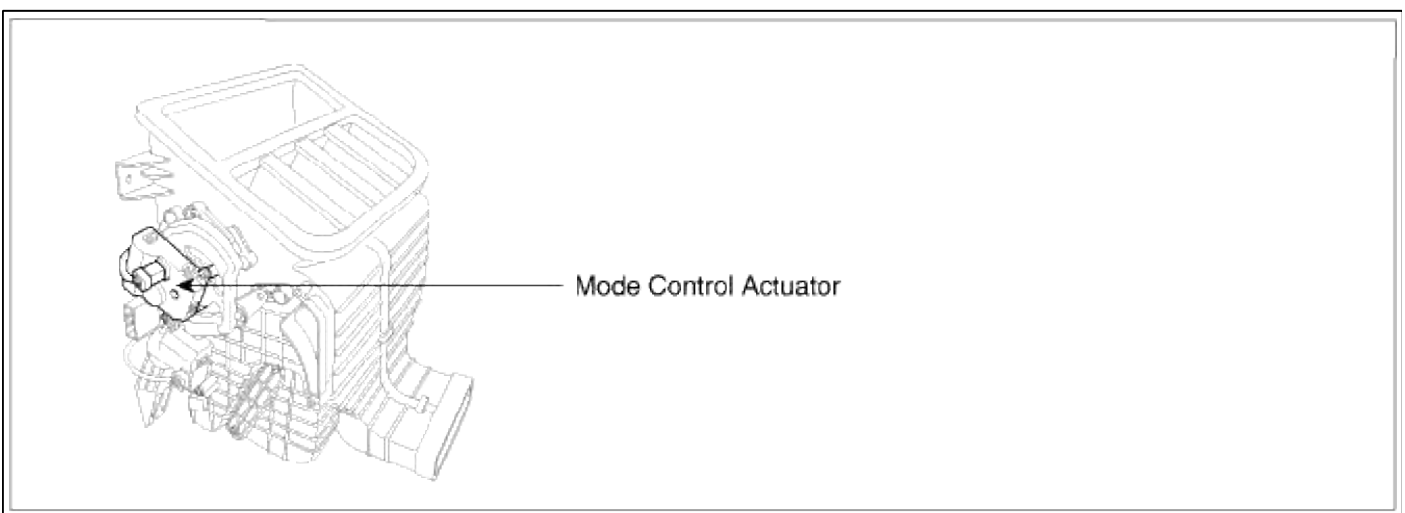
Go to the applicable troubleshooting procedure.

**NO**

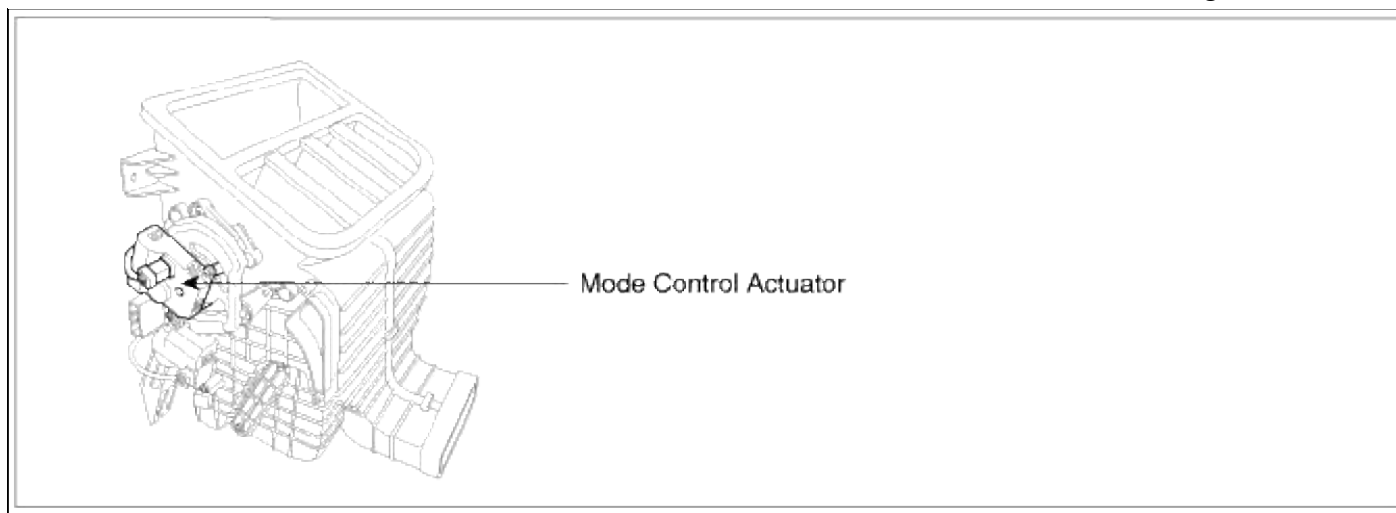
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B1250

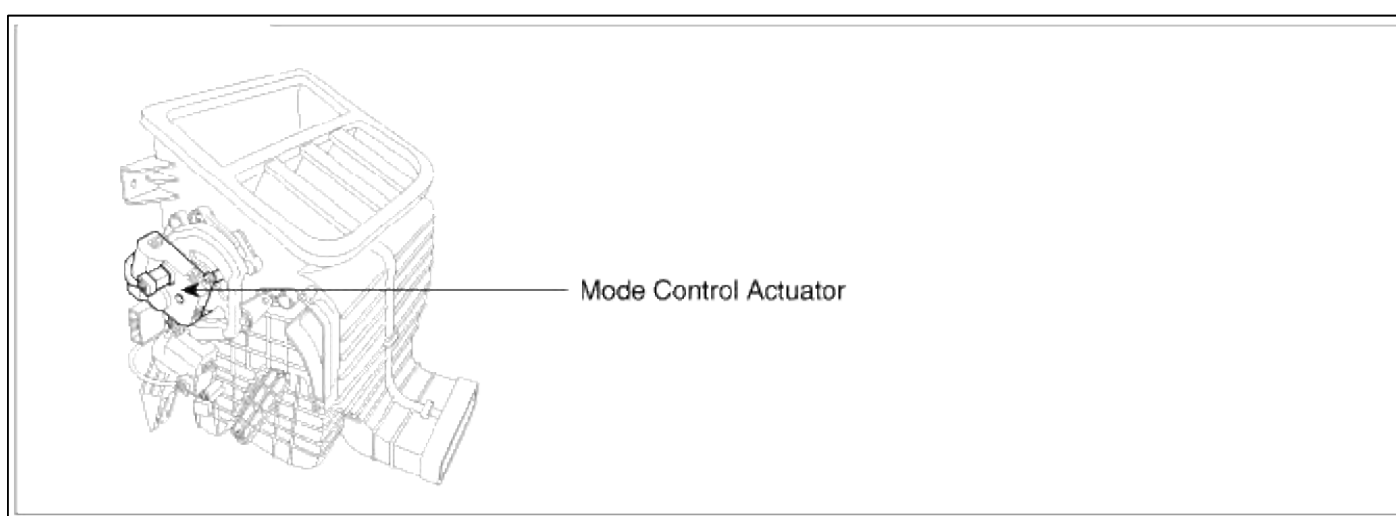
#### COMPONENT LOCATION



#### COMPONENT LOCATION



## COMPONENT LOCATION



## GENERAL DESCRIPTION

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## DTC DESCRIPTION

The A/C controller sets DTC B1250 if there is a short to power in the Direction potentiometer.

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## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty driver direction potentiometer</li> <li>• Open circuit in harness</li> </ul>
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Fix vent position	

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Short circuit in harness</li> <li>• Faulty driver direction potentiometer</li> <li>• Open circuit in harness</li> </ul>
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Detecting time	• 0.3 sec	
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Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Fix vent position	

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"



3. Monitor the " DIRECTION POTENTIO." parameter on the scantool while operating mode switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	13.0 °C	▲
IN-CAR TEMP.SENSOR	11.5 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	13.0 °C	■
DRIVER PHOTO SENSOR	0.00 V	
AIR MIX POPENTIO.	92.54 %	
<b>DIRECTION POTENTIO.</b>	<b>100 %</b>	
PASSENGER PHOTO SENSOR	255	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1250.

1.1 DIAGNOSTIC TROUBLE CODES		
<b>B1250 DIRECTION P. - HIGH INPUT</b>		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>		

Fig. 2

4. Are the DTC B1250 present and is parameter of "DIRECTION POTENTIO." fixed?

Parameter of "DIRECTION POTENTIO." will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Direction potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " DIRECTION POTENTIO." parameter on the scantool while operating mode switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	13.0 °C	▲
IN-CAR TEMP.SENSOR	11.5 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	13.0 °C	■
DRIVER PHOTO SENSOR	0.00 V	
AIR MIX POPENTIO.	92.54 %	
<b>DIRECTION POTENTIO.</b>	<b>100 %</b>	
PASSENGER PHOTO SENSOR	255	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

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1.1 DIAGNOSTIC TROUBLE CODES		
<b>B1250 DIRECTION P. - HIGH INPUT</b>		
NUMBER OF DTC : 1 ITEMS		
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Fig. 2

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**YES**

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## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the " DIRECTION POTENTIO." parameter on the scantool while operating mode switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	13.0 °C
IN-CAR TEMP.SENSOR	11.5 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO.	92.54 %
<b>DIRECTION POTENIO.</b>	<b>100 %</b>
PASSENGER PHOTO SENSOR	255

**Fig. 1**

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B1250.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B1250 DIRECTION P. - HIGH INPUT</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

## 4. Are the DTC B1250 present and is parameter of "DIRECTION POTENTIO." fixed?

Parameter of "DIRECTION POTENTIO." will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Direction potentiometer.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

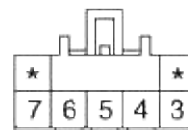
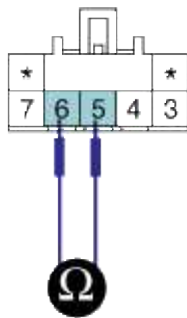
1. Check for short in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "5" and "6" of Direction potentiometer.

Specification : Approx.  $\infty \Omega$



- 1. -
- 2. -
- 3. Motor (Def)
- 4. Motor (Vent)
- 5. Potentiometer ground
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit inspection" procedure.

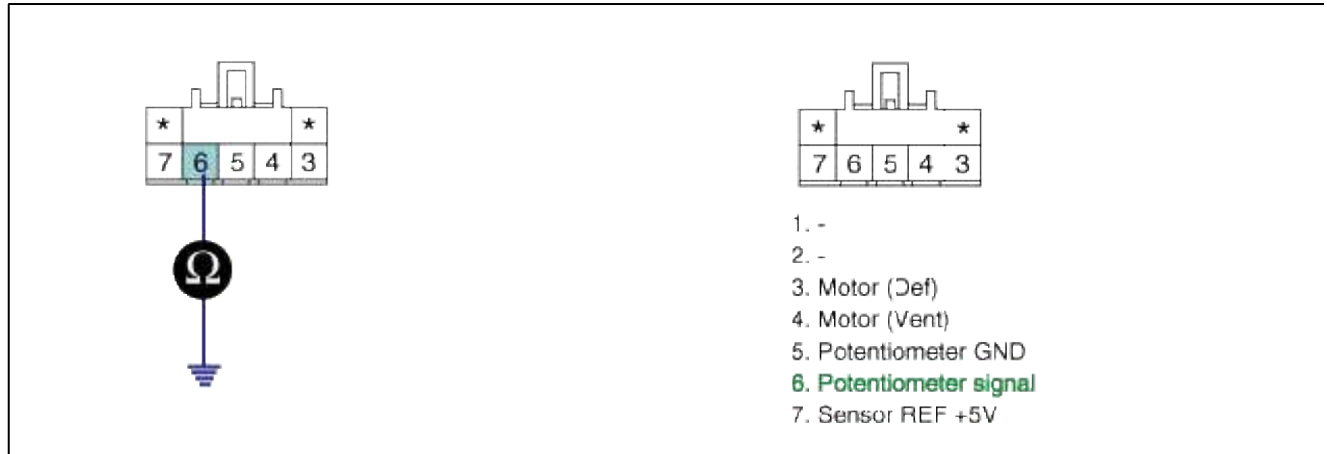
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### GROUND CIRCUIT INSPECTION

1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect mode Actuator.
  - (3) Measure resistance between terminal "6" of evaporator sensor and chassis ground.

Specification :Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

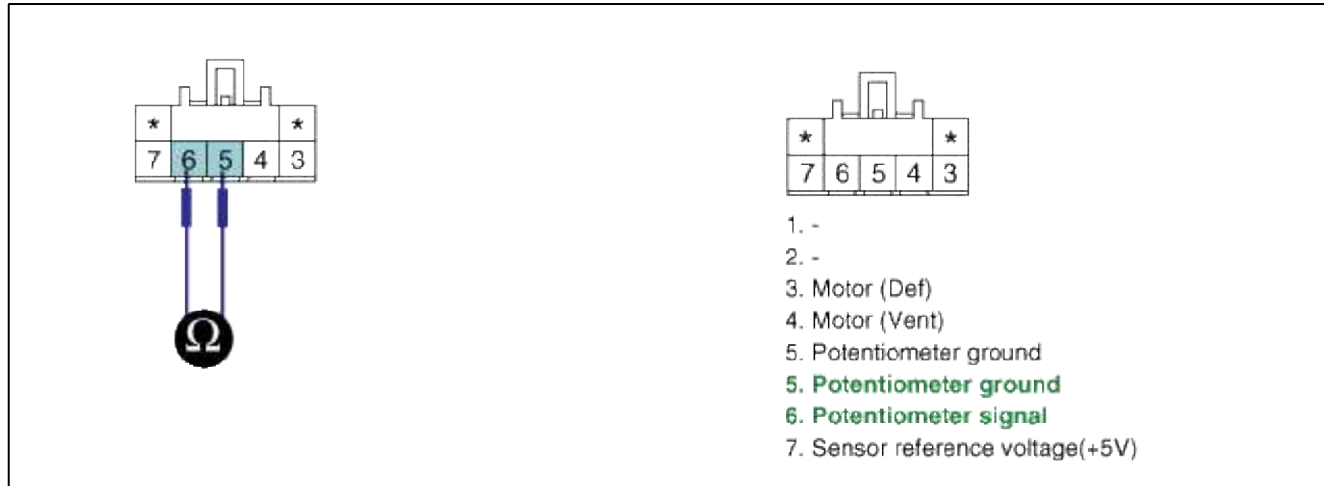
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect mode Actuator.
  - (3) Measure resistance between terminal "5" and "6" of Direction potentiometer.

Specification : Approx.  $\infty \Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit inspection" procedure.

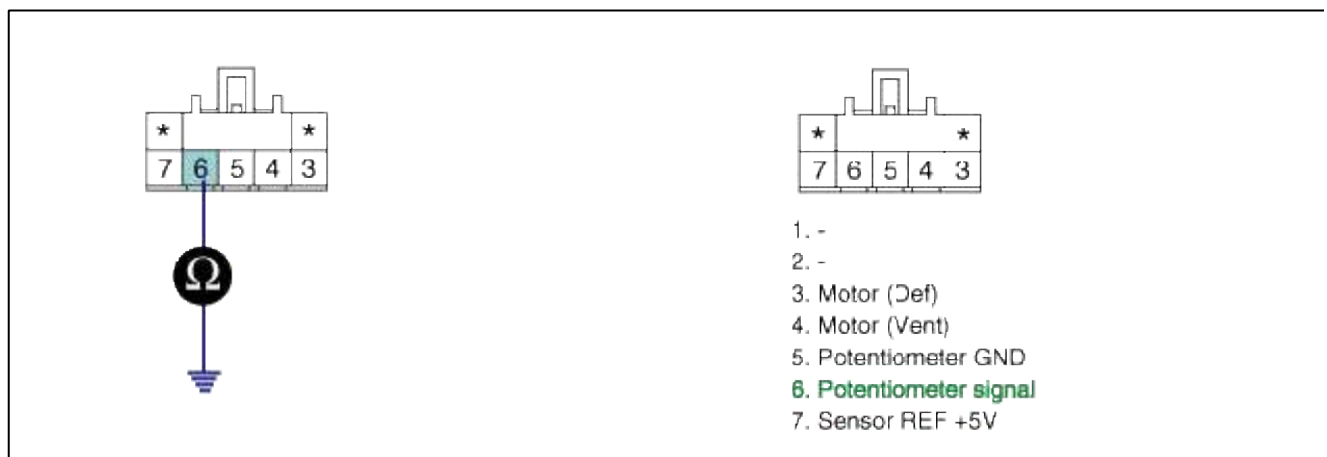
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. Check for open in ground harness.
  - (1) Ignition "OFF"
  - (2) Disconnect mode Actuator.
  - (3) Measure resistance between terminal "6" of evaporator sensor and chassis ground.

Specification : Approx.  $0 \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection " procedure.

**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

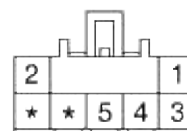
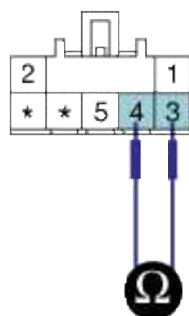
1. Check for short in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "3" and "4" of Direction potentiometer.

Specification : Approx.  $\infty \Omega$



- 1. Motor (Vent)
- 2. Motor (Def)
- 3. **Sensor reference voltage(+5V)**
- 4. **Potentiometer signal**
- 5. Potentiometer ground

(4) Is the measured resistance within specifications?

**YES**

Go to "Ground circuit inspection" procedure.

**NO**

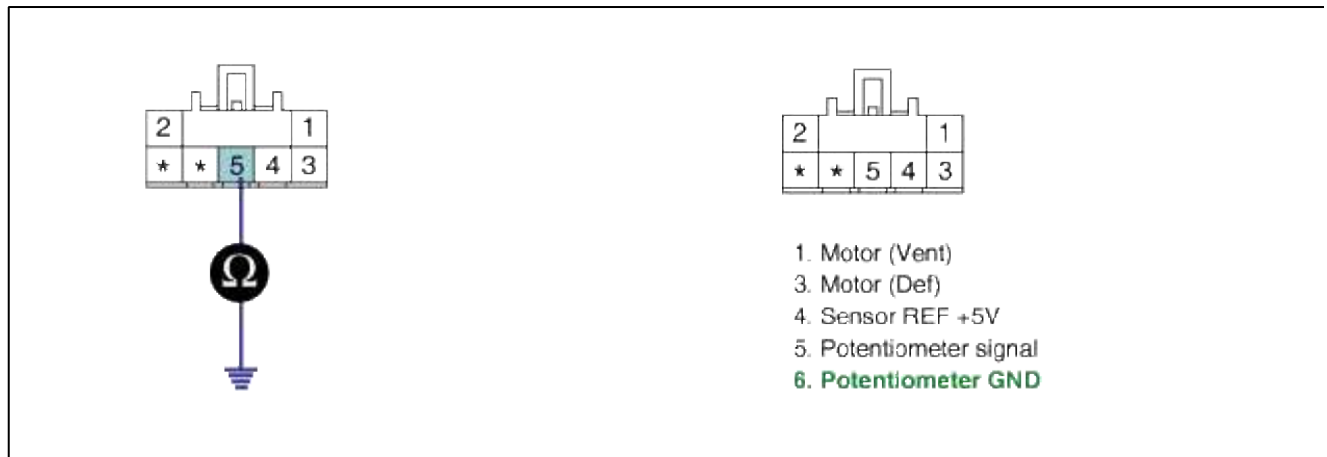
Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

## 1. Check for open in ground harness.

- (1) Ignition "OFF"
- (2) Disconnect mode Actuator.
- (3) Measure resistance between terminal "5" of evaporator sensor and chassis ground.

Specification :Approx. 0  $\Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Component Inspection" procedure.

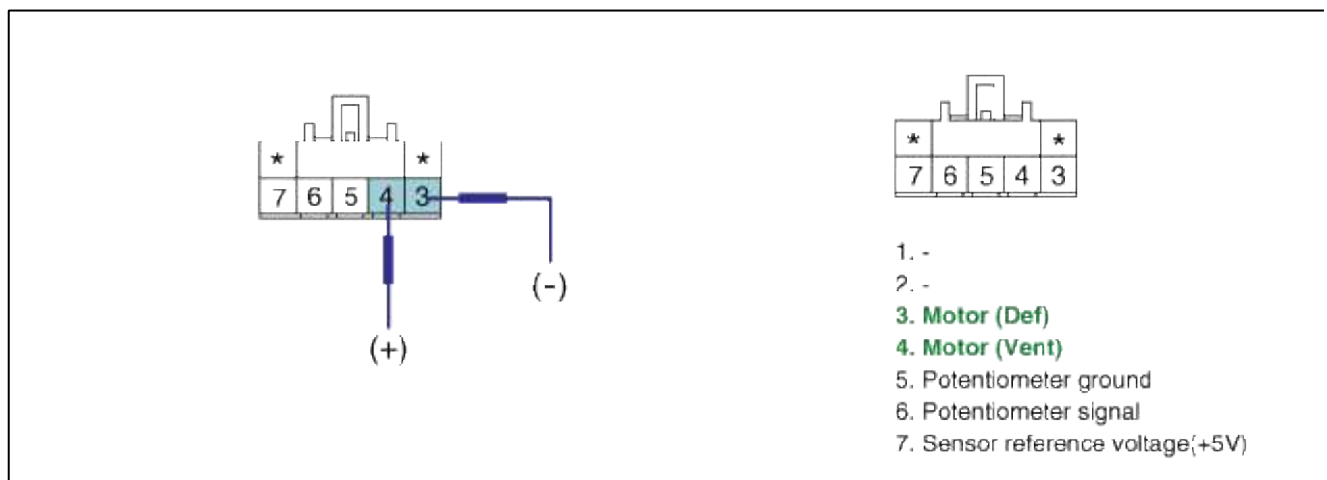
**NO**

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator.

- (1) Ignition "OFF"
- (2) Disconnect Direction potentiometer.
- (3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal "3" and ground terminal "4".
- (4) Verify that the mode actuator operates to the def mode when the connections are reversed.



(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

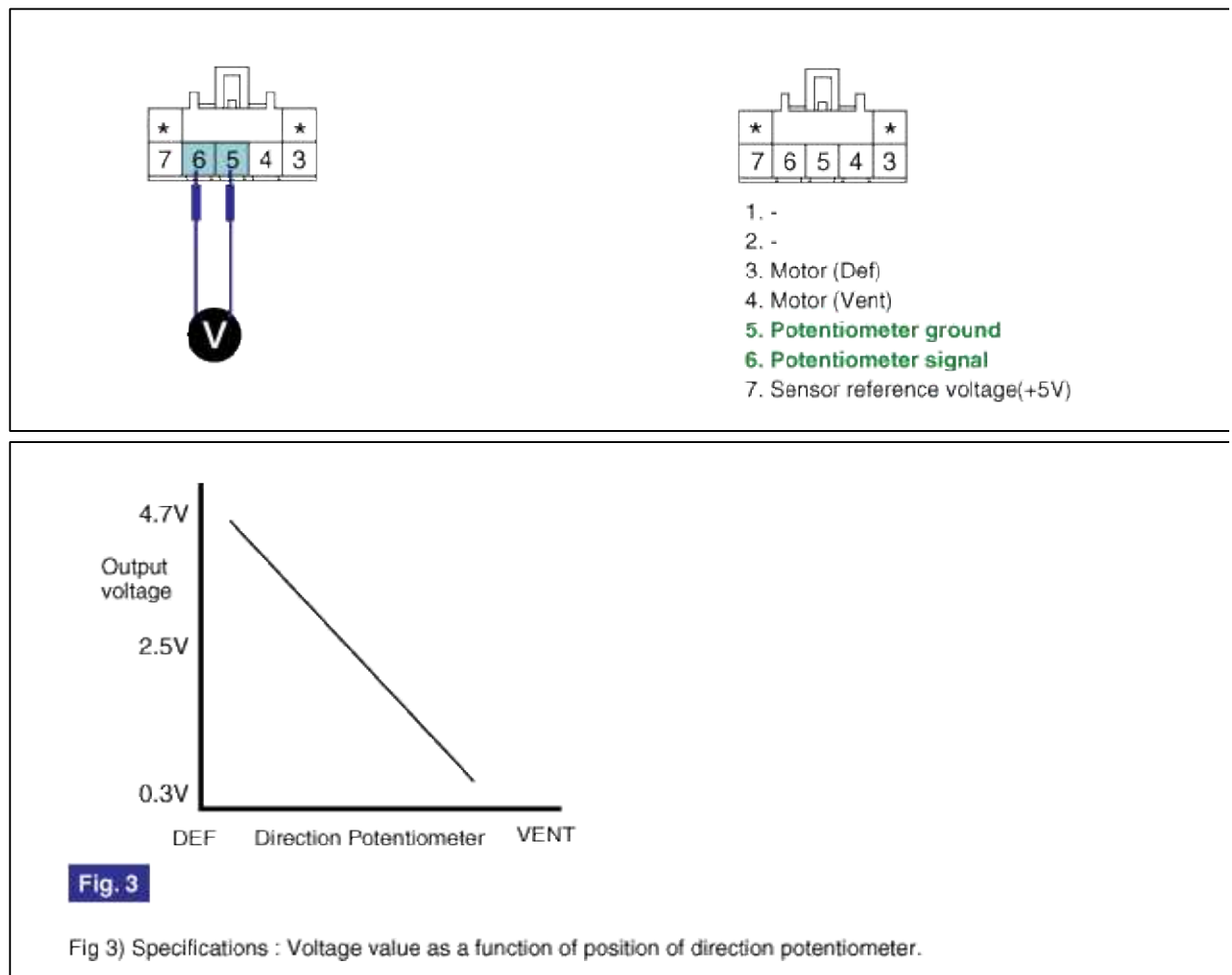
## 2. Check potentiometer

(1) Ignition "ON"

(2) Connect Direction potentiometer.

(3) Measure voltage between terminal "5" and "6" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

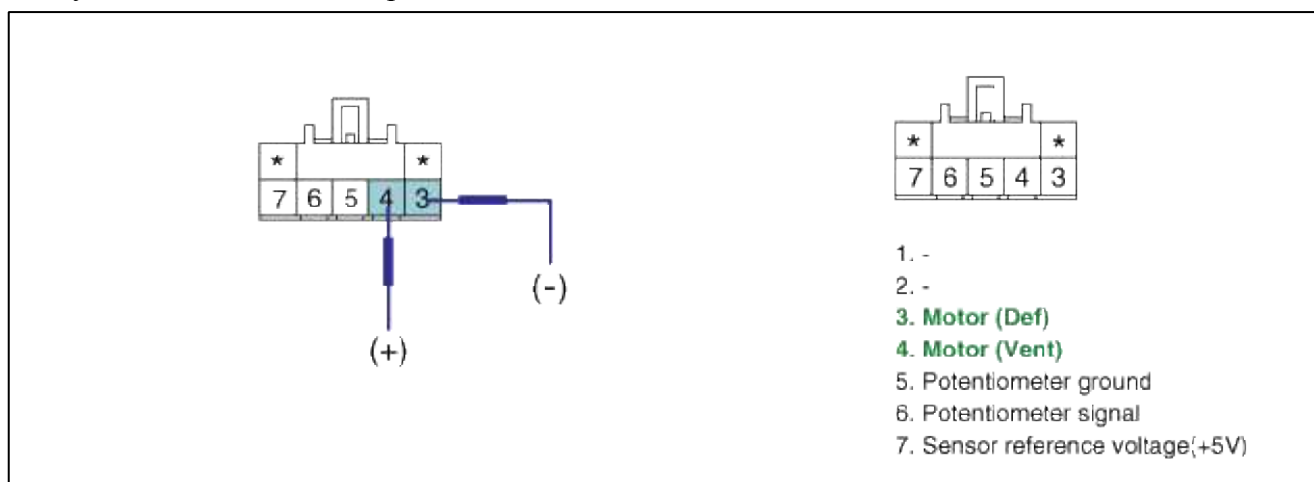
Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION



## 1. Check actuator.

- (1) Ignition "OFF"
- (2) Disconnect Direction potentiometer.
- (3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal "3" and ground terminal "4".
- (4) Verify that the mode actuator operates to the def mode when the connections are reversed.



## (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

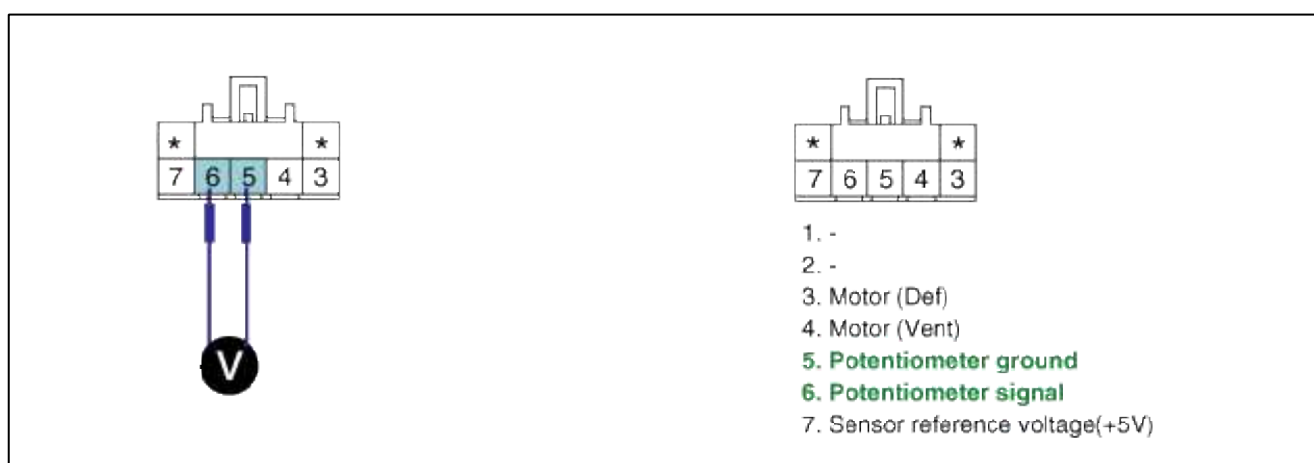
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Direction potentiometer.
- (3) Measure voltage between terminal "5" and "6" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



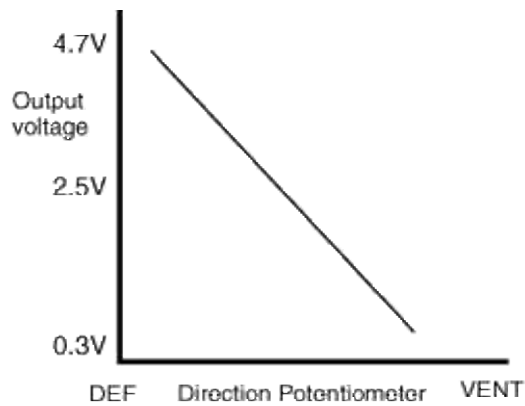
**Fig. 3**

Fig 3) Specifications : Voltage value as a function of position of direction potentiometer.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

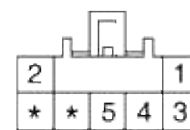
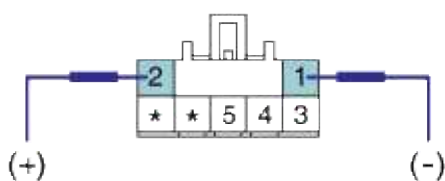
1. Check actuator.

(1) Ignition "OFF"

(2) Disconnect Direction potentiometer.

(3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal "1" and grounding terminal "2".

(4) Verify that the mode actuator operates to the def mode when the connections are reversed.



- 1. Motor (Vent)
- 2. Motor (Def)
- 3. Sensor reference voltage(+5V)
- 4. Potentiometer signal
- 5. Potentiometer ground

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

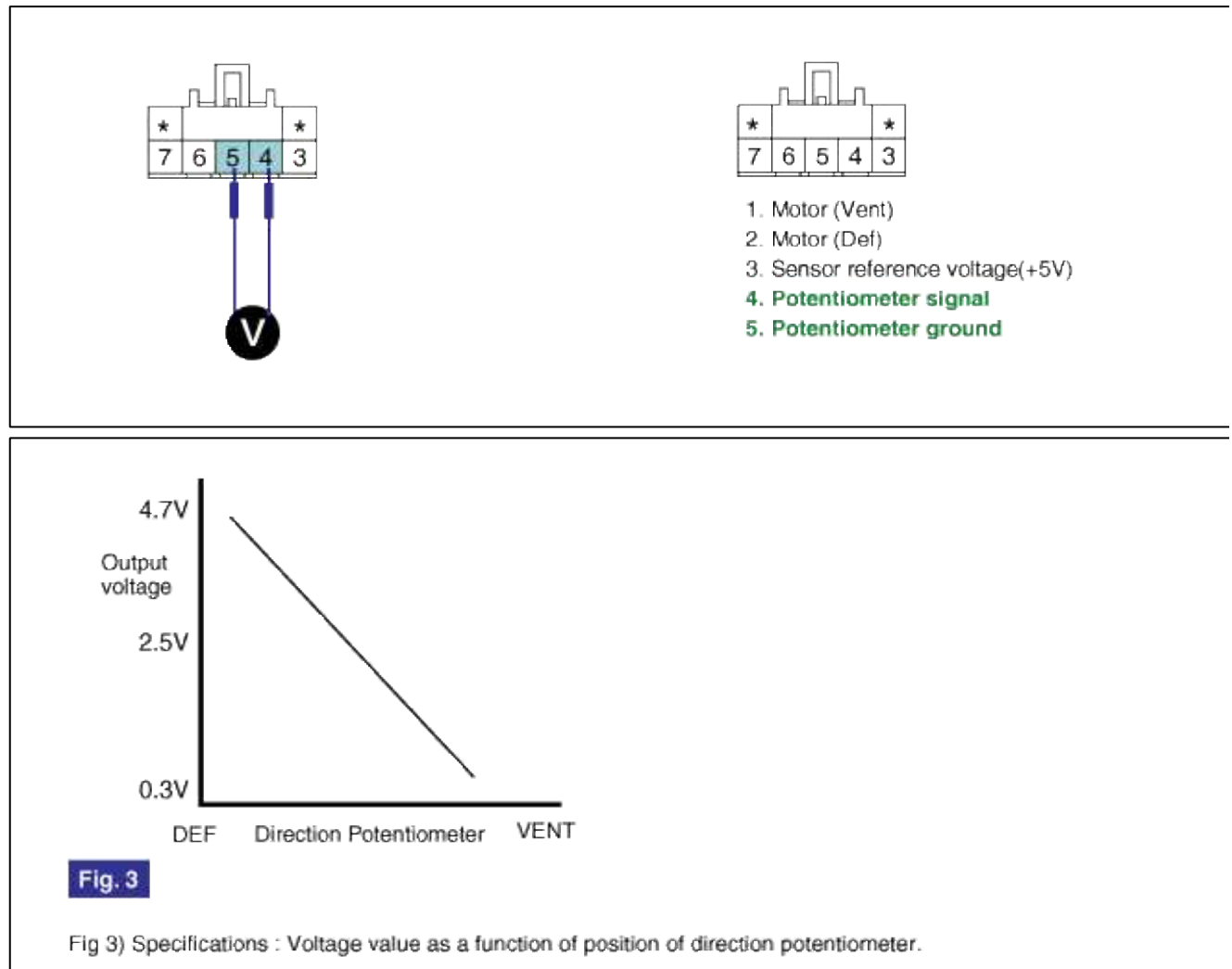
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Direction potentiometer.
- (3) Measure voltage between terminal "4" and "5" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.

3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

#### VERIFICATION OF VEHICLE REPAIR

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**YES**

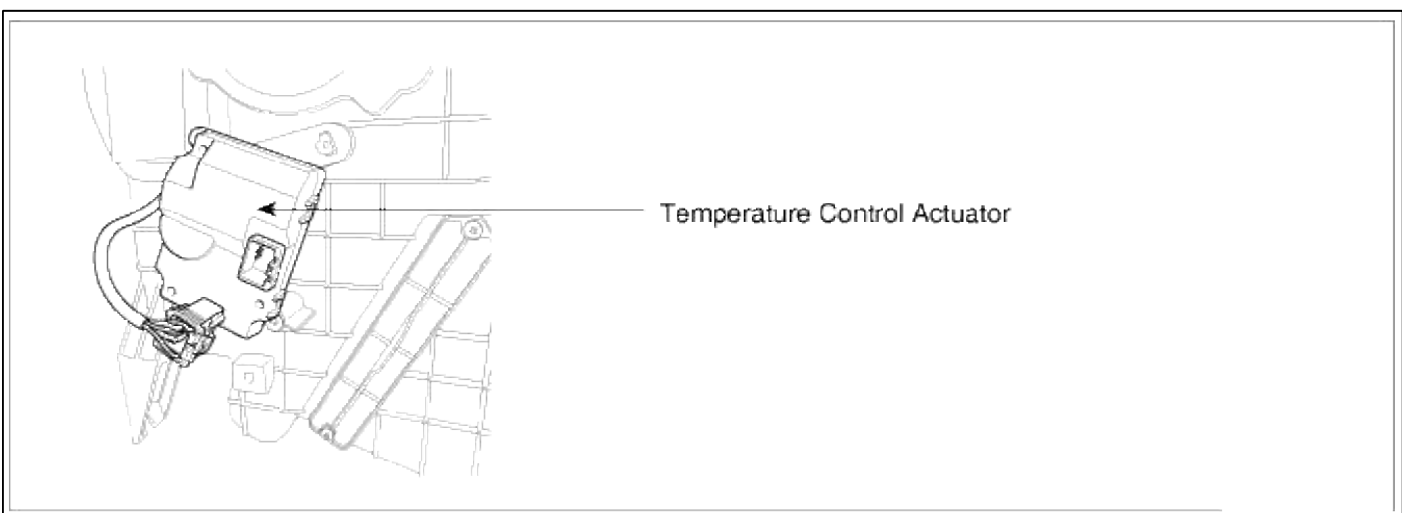
Go to the applicable troubleshooting procedure.

**NO**

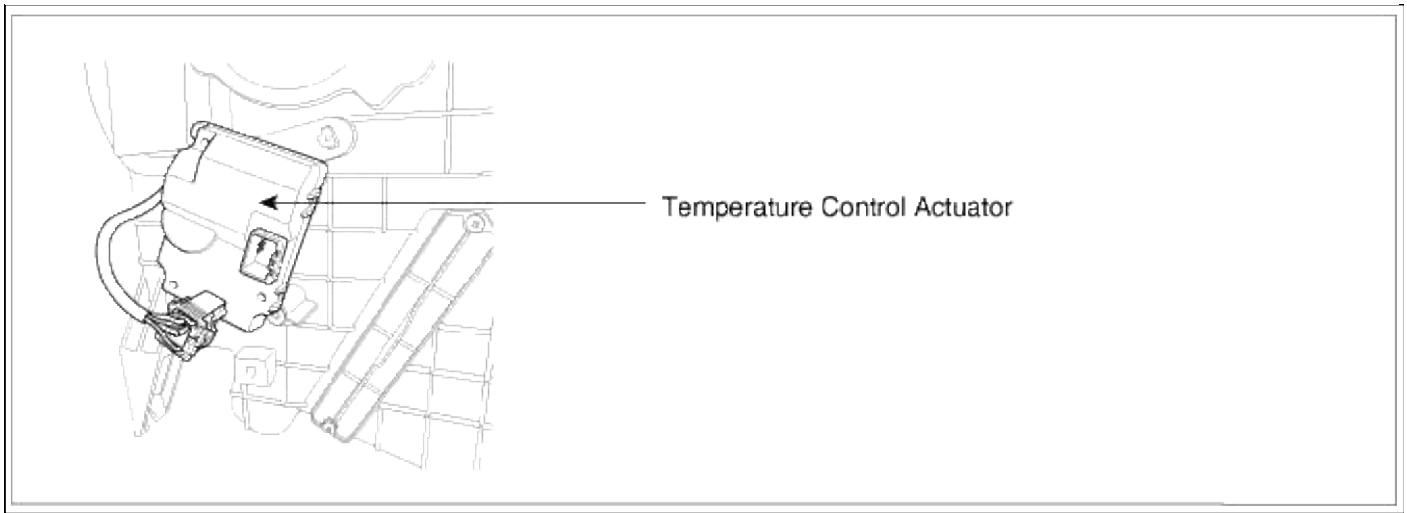
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B2406

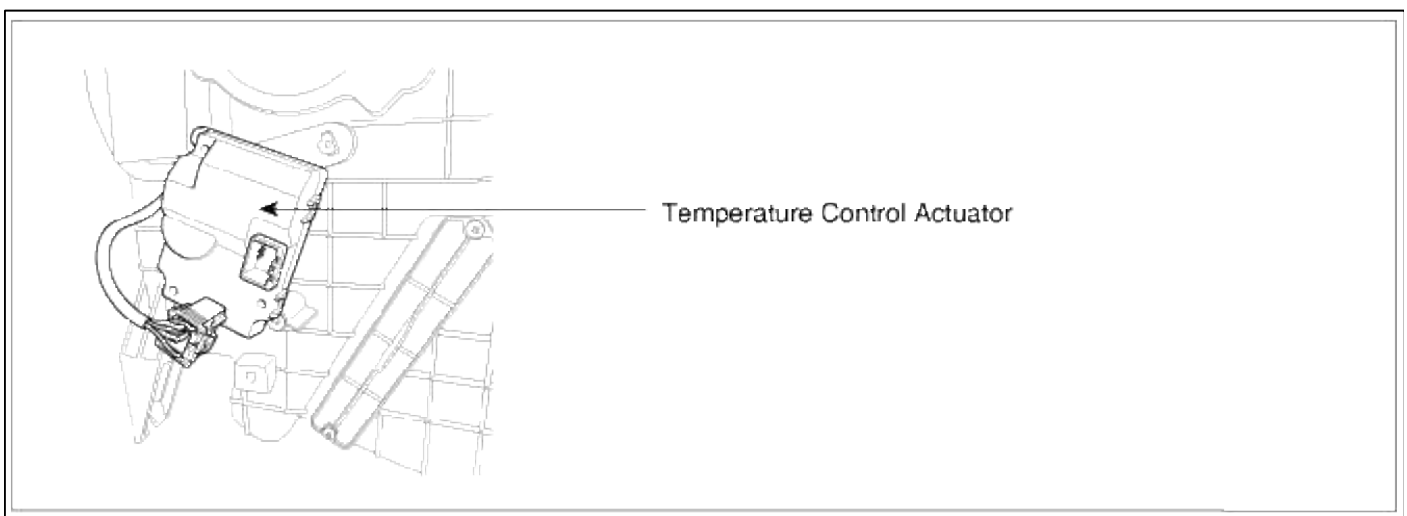
#### COMPONENT LOCATION



#### COMPONENT LOCATION



## COMPONENT LOCATION



## GENERAL DESCRIPTION

Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

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## DTC DESCRIPTION

The A/C controller sets DTC B2406 if the air mix actuator doesn't move to intended position within 40sec (In this case, A/C controller try to move temp. door for 2sec. 3 times, every 20 sec. before setting DTC).

## DTC DESCRIPTION

The A/C controller sets DTC B2406 if the air mix actuator doesn't move to intended position within 40sec (In this case, A/C controller try to move temp. door for 2sec. 3 times, every 20 sec. before setting DTC).

## DTC DESCRIPTION

The A/C controller sets DTC B2406 if the air mix actuator doesn't move to intended position within 40sec (In this case, A/C controller try to move temp. door for 2sec. 3 times, every 20 sec. before setting DTC).

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> <li>• Fault A/C Control Unit</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> <li>• Fault A/C Control Unit</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> <li>• Fault A/C Control Unit</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Driver Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
<b>AIR MIX POPENIO.(DR.)</b>	<b>22.7 %</b>
DIRECTION POTENIO.DR.	51.76 %
PASSENGER PHOTO SENSOR	255
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B2406 DRIVER AIR MIX MOTOR</b>	
NUMBER OF DTC : 1 ITEMS	
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>	

Fig. 2

Fig 2 : DTC B2406.

4. Are the DTC B2406 present and is parameter of "Driver AIR MIX Potentiometer" fixed?

There is any fault in Driver AIR MIX Motor. If the parameter of "Driver AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position.

☐ YES

Go to "Inspection" procedure.

☐ NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Driver Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	14.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	13.0 °C	■
DRIVER PHOTO SENSOR	0.00 V	
AIR MIX POPENIO.(DR.)	22.7 %	
DIRECTION POTENIO.DR.	51.76 %	
PASSENGER PHOTO SENSOR	255	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B2406.

1.1 DIAGNOSTIC TROUBLE CODES		
B2406 DRIVER AIR MIX MOTOR		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>		

Fig. 2

#### 4. Are the DTC B2406 present and is parameter of "Driver AIR MIX Potentiometer" fixed?

There is any fault in Driver AIR MIX Motor. If the parameter of "Driver AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Driver Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	14.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	13.0 °C	■
DRIVER PHOTO SENSOR	0.00 V	
AIR MIX POPENIO.(DR.)	22.7 %	
DIRECTION POTENIO.DR.	51.76 %	
PASSENGER PHOTO SENSOR	255	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B2406.

1.1 DIAGNOSTIC TROUBLE CODES		
B2406 DRIVER AIR MIX MOTOR		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>		

Fig. 2



## 4. Are the DTC B2406 present and is parameter of "Driver AIR MIX Potentiometer" fixed?

There is any fault in Driver AIR MIX Motor. If the parameter of "Driver AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position.

☐ YES

Go to "Inspection" procedure.

☐ NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

## 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## 3. Has a problem been found?

☐ YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

☐ NO

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

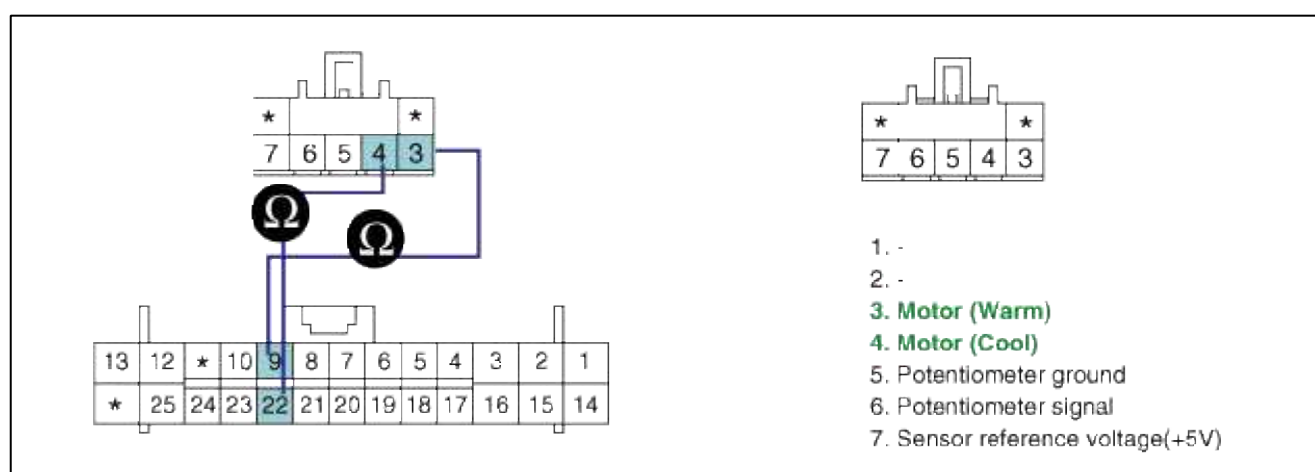
## 1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Driver Air Mix potentiometer.

(3) Measure resistance between terminal "3,4" of Driver Air Mix Motor and terminal "9,22" of A/C control unit.

Specification : Approx. 0  $\Omega$



## (4) Is the measured resistance within specifications?

☐ YES

Go to "Check for short to ground in harness" procedure.

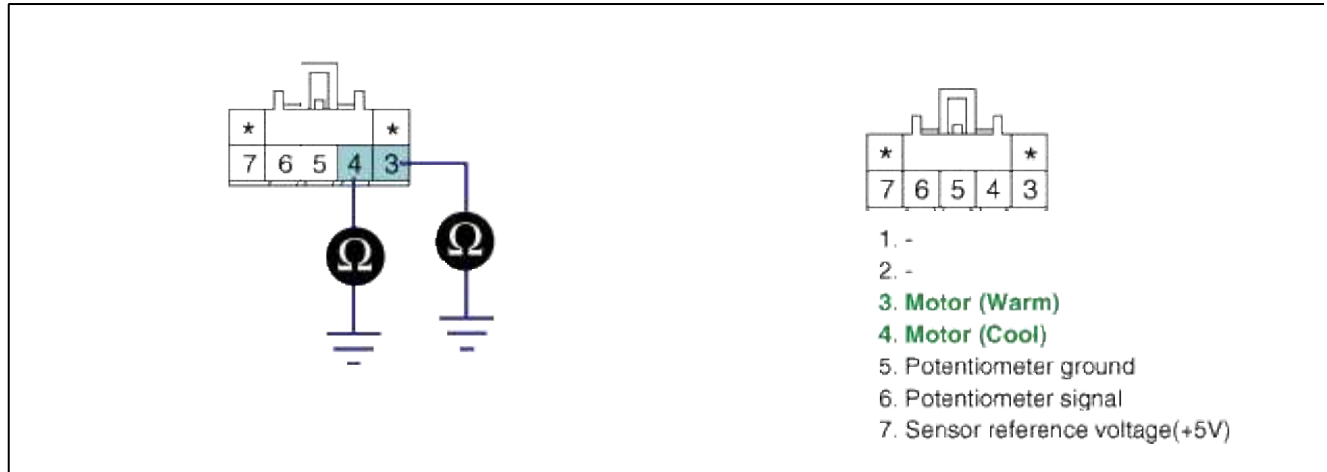
☐ NO

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Actuator.
- (3) Measure resistance between terminal "3,4" of Driver Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

## 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## 3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

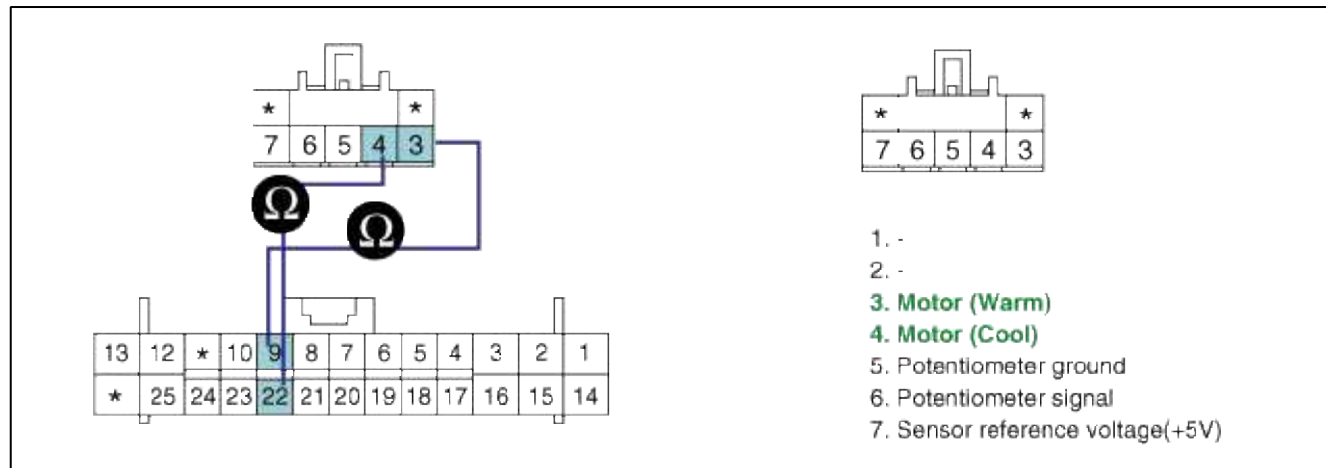
**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Driver Air Mix potentiometer.
  - (3) Measure resistance between terminal "3,4" of Driver Air Mix Motor and terminal "9,22" of A/C control unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

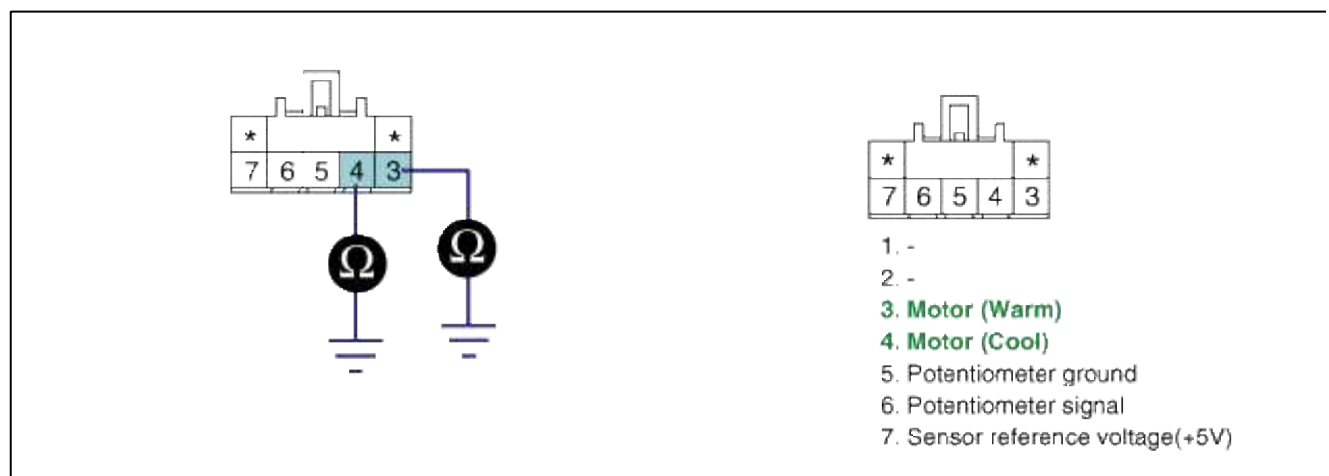
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Actuator.
- (3) Measure resistance between terminal "3,4" of Driver Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

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Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

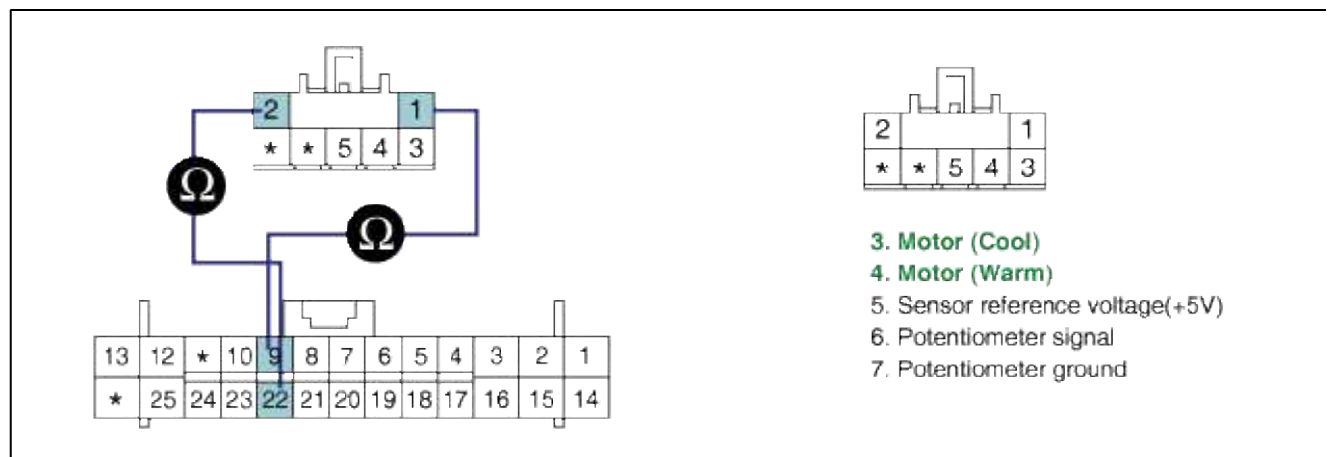
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Driver Air Mix potentiometer.

(3) Measure resistance between terminal "1,2" of Driver Air Mix Motor and terminal "9,22" of A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

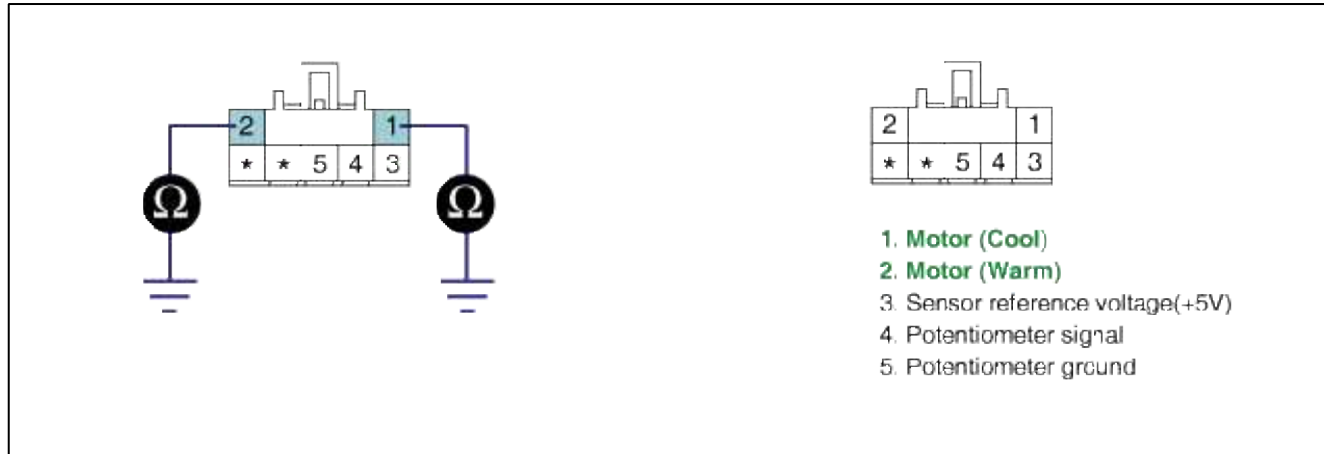
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Actuator.
- (3) Measure resistance between terminal "1,2" of Driver Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

## 1. Check actuator.

Check if Driver Air Mix Actuator works properly through ACTUATION TEST.

- (1) Ignition : ON
- (2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

1.3 ACTUATION TEST	
DRIVER AIR MIX DOOR - DRIVE 50%	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE RUNNING
PRESS [STRT], IF YOU ARE READY!	
STRT	STOP

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Driver Air Mix Actuator work properly?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

### 1. Check actuator.

Check if Driver Air Mix Actuator works properly through ACTUATION TEST.

(1) Ignition : ON

(2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

1.3 ACTUATION TEST	
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DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE RUNNING
PRESS [STRT], IF YOU ARE READY!	
STRT	STOP

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Driver Air Mix Actuator work properly?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

## 1. Check actuator.

Check if Driver Air Mix Actuator works properly through ACTUATION TEST.

(1) Ignition : ON

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PRESS [STRT], IF YOU ARE READY!	
STRT	STOP

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Driver Air Mix Actuator work properly?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

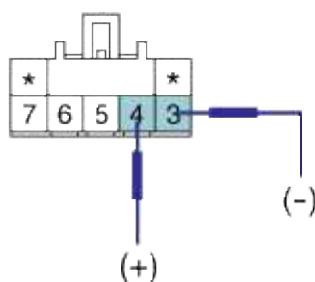
## 1. Check actuator motor.

(1) Ignition "OFF"

(2) Disconnect Driver Air Mix Potentiometer.

(3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".

(4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



- 1. -
- 2. -
- 3. Motor (Warm)
- 4 Motor (Cool)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

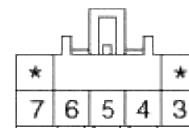
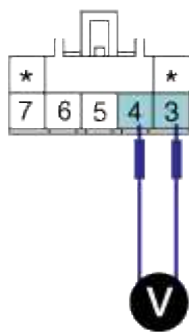
## 2. Check potentiometer

(1) Ignition "ON"

(2) Connect Driver Air Mix potentiometer.

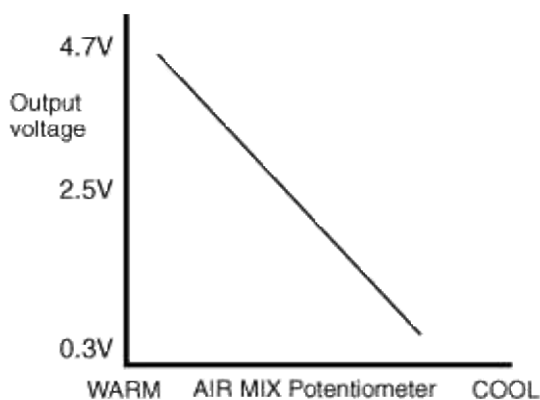
(3) Measure voltage between terminal "3" and "4" of Driver Air Mix potentiometer while operating the temp. switch

Specification : Refer the specifications in fig 3)



- 1. -
- 2. -
- 3. Motor (Warm)
- 4. Motor (Cool)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

Door position	Voltage (3-4)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more



**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.



(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

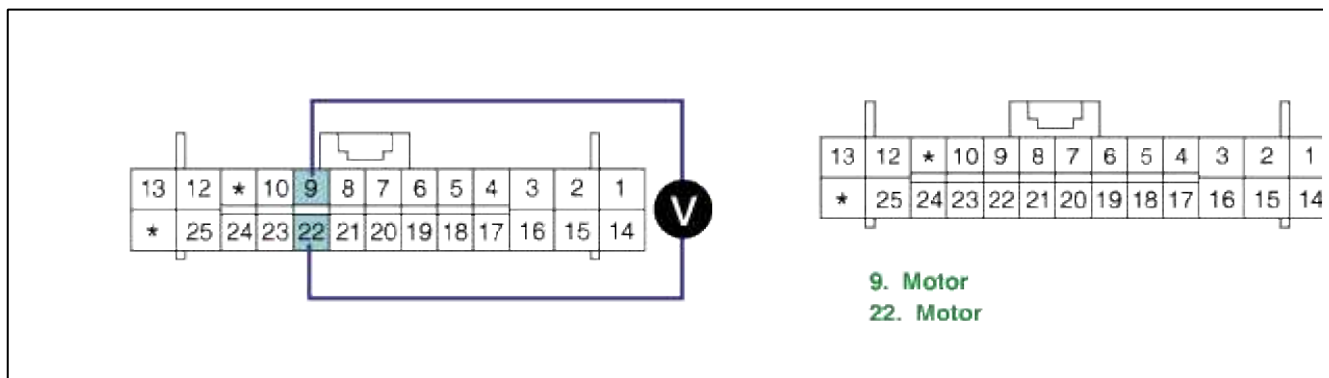
### 3. Check A/C Control Unit.

(1) Engine "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "9" and "22" of A/C Control Unit while operating the temp. switch.

Specification :Approx. 12V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

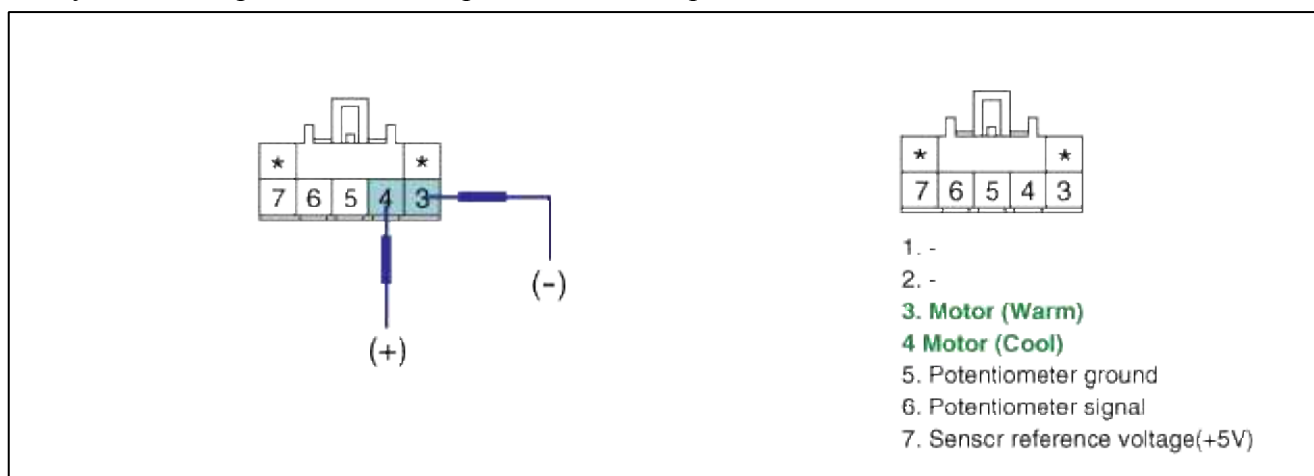
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

### COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



## (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

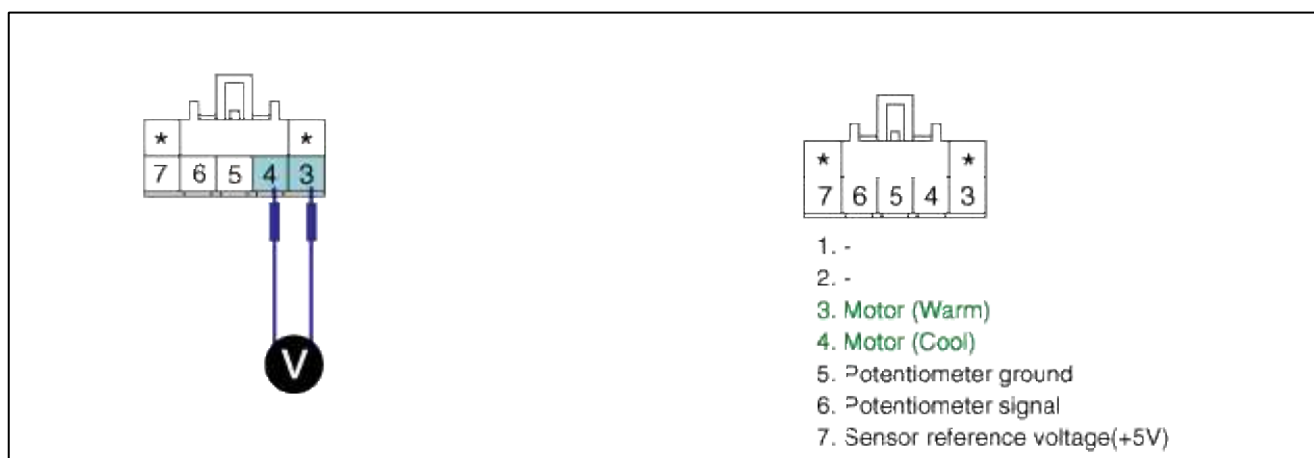
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Driver Air Mix potentiometer.
- (3) Measure voltage between terminal "3" and "4" of Driver Air Mix potentiometer while operating the temp. switch

Specification : Refer the specifications in fig 3)



Door position	Voltage (3-4)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more

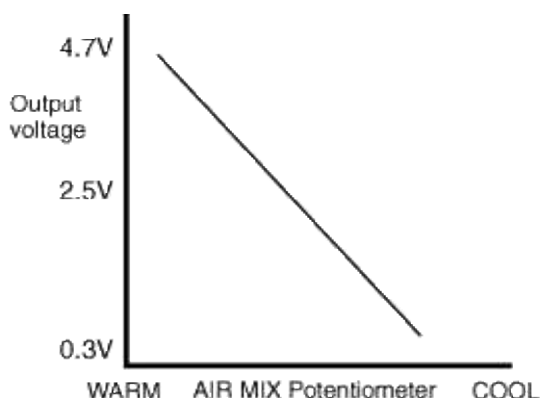
**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace and then go to "Verification of Vehicle Repair" procedure.

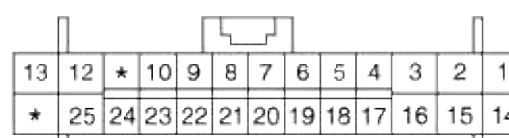
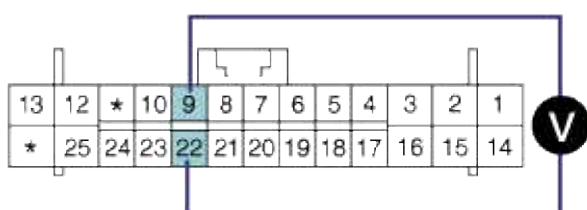
3. Check A/C Control Unit.

(1) Engine "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "9" and "22" of A/C Control Unit while operating the temp. switch.

Specification : Approx. 12V



9. Motor  
22. Motor

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

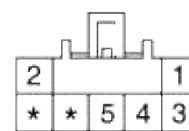
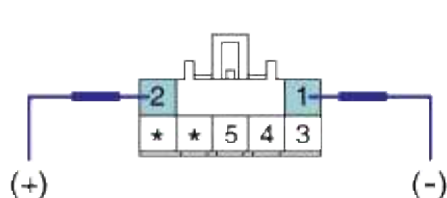
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "1" and grounding terminal "2".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



- 1. Motor (Cool)
- 2. Motor (Warm)
- 3. Sensor reference voltage(+5V)
- 4. Potentiometer signal
- 5. Potentiometer ground

## (5) Does the actuator work properly?

YES

Go to "Check potentiometer" procedure.

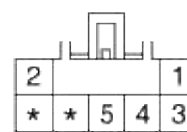
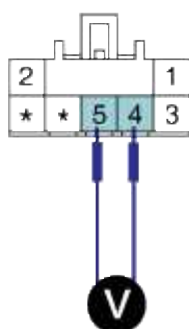
NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Driver Air Mix potentiometer.
- (3) Measure voltage between terminal "4" and "5" of Driver Air Mix potentiometer while operating the temp. switch

Specification : Refer the specifications in fig 3)



- 1. Motor (Cool)
- 2. Motor (Warm)
- 3. Sensor reference voltage(+5V)
- 4. Potentiometer signal
- 5. Potentiometer ground

Door position	Voltage (4-5)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or more

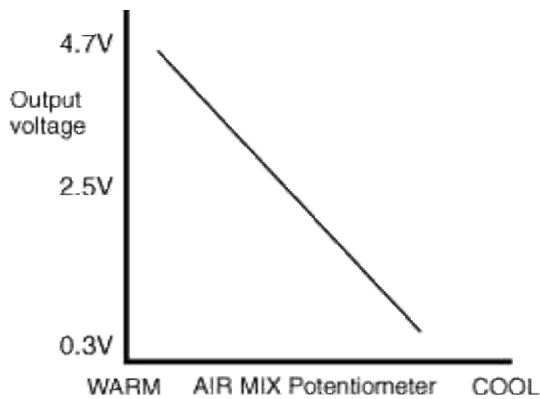
**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace and then go to "Verification of Vehicle Repair" procedure.

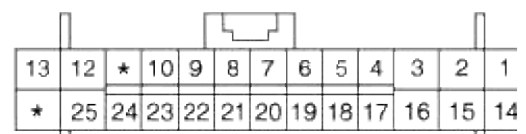
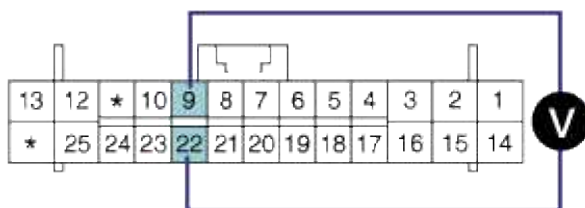
3. Check A/C Control Unit.

(1) Engine "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "9" and "22" of A/C Control Unit while operating the temp. switch.

Specification : Approx. 12V



9. Motor  
22. Motor

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

#### VERIFICATION OF VEHICLE REPAIR

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**YES**

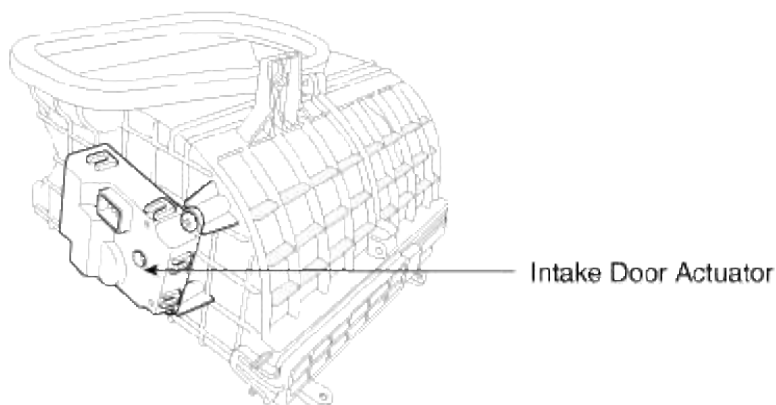
Go to the applicable troubleshooting procedure.

**NO**

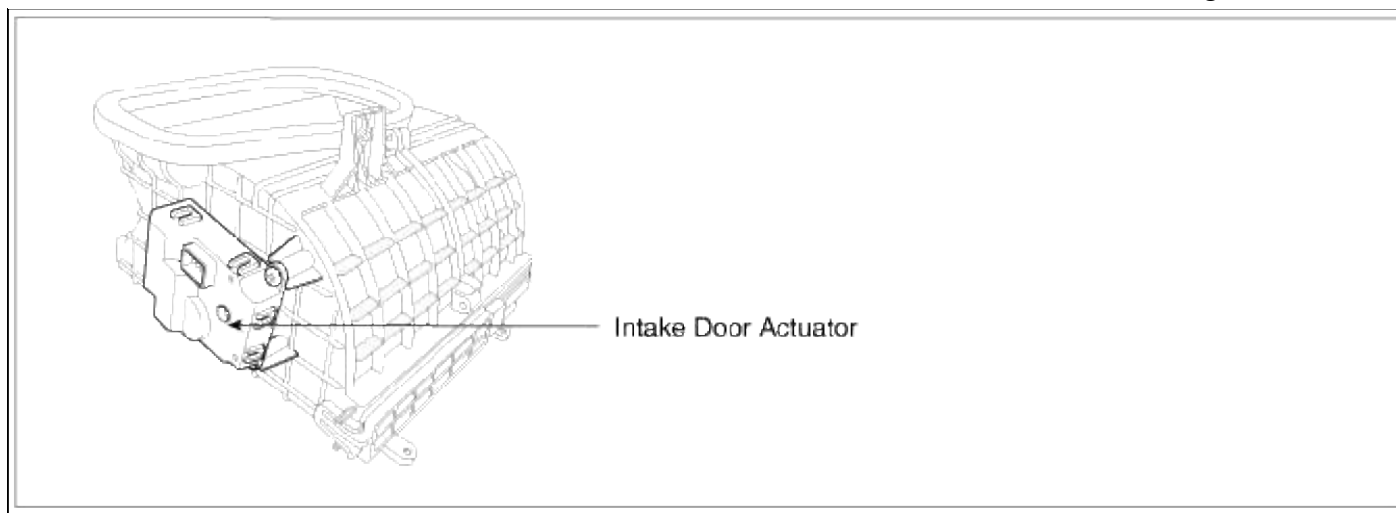
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B2408

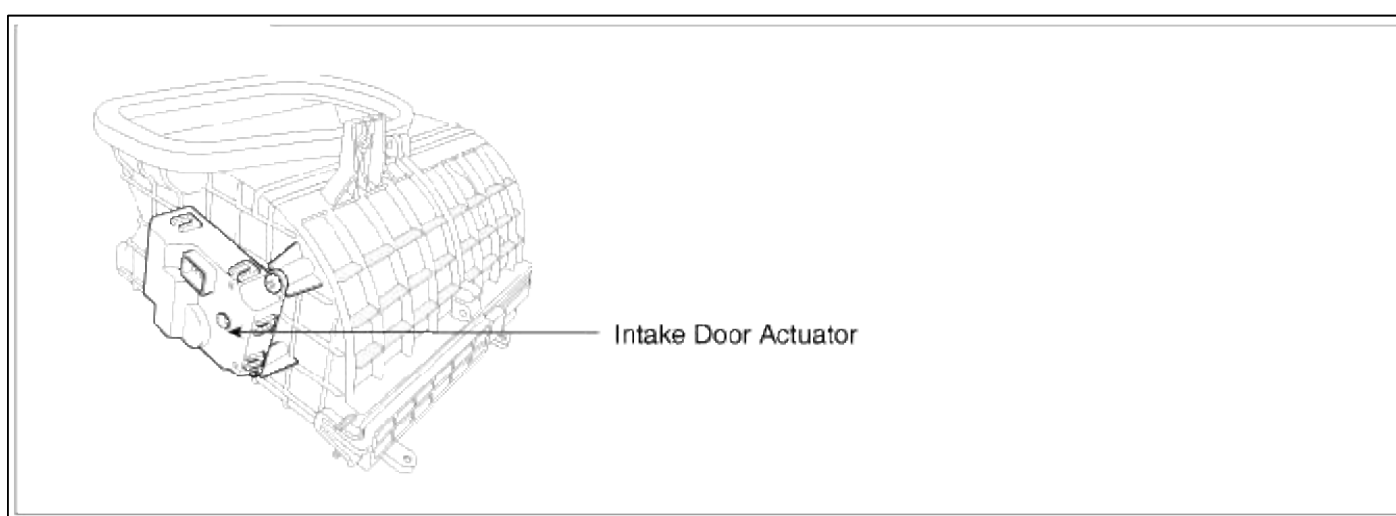
#### COMPONENT LOCATION



#### COMPONENT LOCATION



## COMPONENT LOCATION



## GENERAL DESCRIPTION

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, A/C controller recirculationeives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with fresh mode signal, intake door is closed and with fresh mode signal, intake door is opened.

## GENERAL DESCRIPTION

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, A/C controller recirculationeives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with fresh mode signal, intake door is closed and with fresh mode signal, intake door is opened.

## GENERAL DESCRIPTION

Intake door located at heater unit controls the inlet of car. When driver operates the intake switch, A/C controller recirculationeives mode signal from intake switch and operates intake door actuator to turn intake door to intended position. (with fresh mode signal, intake door is closed and with fresh mode signal, intake door is opened.

## DTC DESCRIPTION

The A/C controller sets DTC B2408 if the intake motor Doesn't move to intended position within 40sec(The A/C controller attempts to move the intake door for a 2 second duration at a freshquency of 3 times every 20 seconds before storing a DTC.)

## DTC DESCRIPTION

The A/C controller sets DTC B2408 if the intake motor Doesn't move to intended position within 40sec(The A/C

controller attempts to move the intake door for a 2 second duration at a frequency of 3 times every 20 seconds before storing a DTC.)

#### DTC DESCRIPTION

The A/C controller sets DTC B2408 if the intake motor Doesn't move to intended position within 40sec(The A/C controller attempts to move the intake door for a 2 second duration at a frequency of 3 times every 20 seconds before storing a DTC.)

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty Intake potentiometer</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty Intake potentiometer</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

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Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"



### 3. Monitor the "Intake Potentiometer" Parameter on the Scantool while operating Intake switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	14.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	13.0 °C	■
DRIVER PHOTO SENSOR	0.00 V	
AIR MIX POPENIO.(DR.)	84.69 %	
DIRECTION POTFNIO.DR.	51.76 %	
PASSENGER PHOTO SENSOR	255	
<b>INTAKE SENSOR</b>	<b>22.7 %</b>	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B2408.

1.1 DIAGNOSTIC TROUBLE CODES		
<b>B2408 INTAKE MOTOR</b>		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>		

Fig. 2

### 4. Are the DTC B2408 present and is parameter of "Intake Potentiometer" fixed?

There is any fault in Intake potentiometer. If the parameter of "Intake potentiometer" is 30% or less when the actuator operates to the fresh position, or If the parameter is 60% and more when the actuator operates to the recirculation position.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Intake Potentiometer" Parameter on the Scantool while operating Intake switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	14.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	13.0 °C	■
DRIVER PHOTO SENSOR	0.00 V	
AIR MIX POPENIO.(DR.)	84.69 %	
DIRECTION POTFNIO.DR.	51.76 %	
PASSENGER PHOTO SENSOR	255	
<b>INTAKE SENSOR</b>	<b>22.7 %</b>	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

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Fig 1 : The current data in abnormal state.

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<b>B2408 INTAKE MOTOR</b>		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div> </div> <div>HELP</div> </div>		

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DIRECTION POTENIO.DR.	51.76 %
PASSENGER PHOTO SENSOR	255
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<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>	

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Fig 1 : The current data in abnormal state.

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1.1 DIAGNOSTIC TROUBLE CODES
<b>B2408 INTAKE MOTOR</b>
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#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

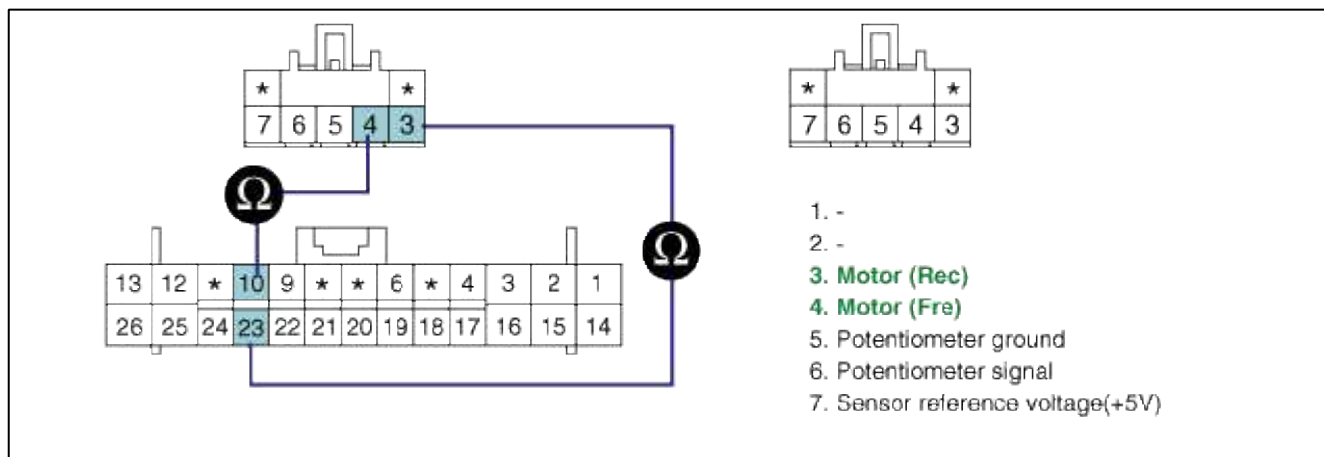
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Intake potentiometer.

(3) Measure resistance between terminal "3,4" of Intake potentiometer and terminal "23,10" of A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

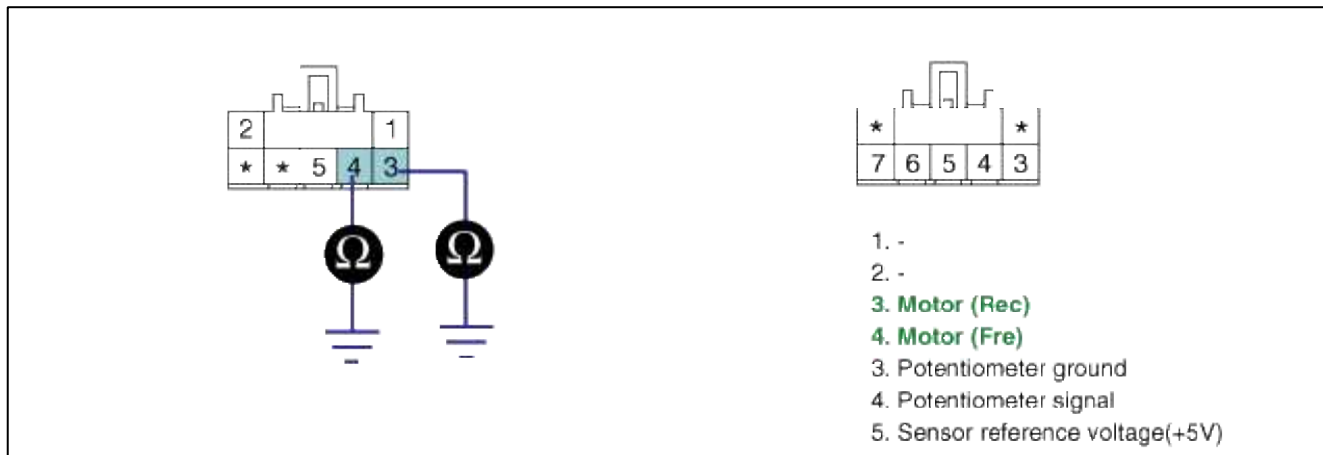
2. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect Driver Air Mix Actuator.

(3) Measure resistance between terminal "3,4" of Driver Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

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3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

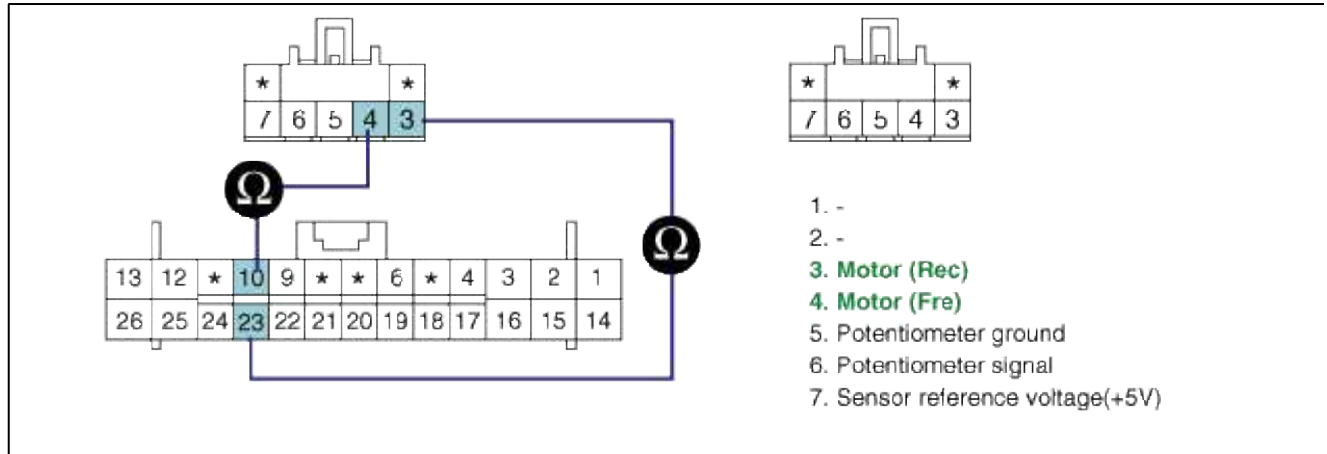
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect Intake potentiometer.
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Specification : Approx. 0  $\Omega$



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**YES**

Go to "Check for short to ground in harness" procedure.

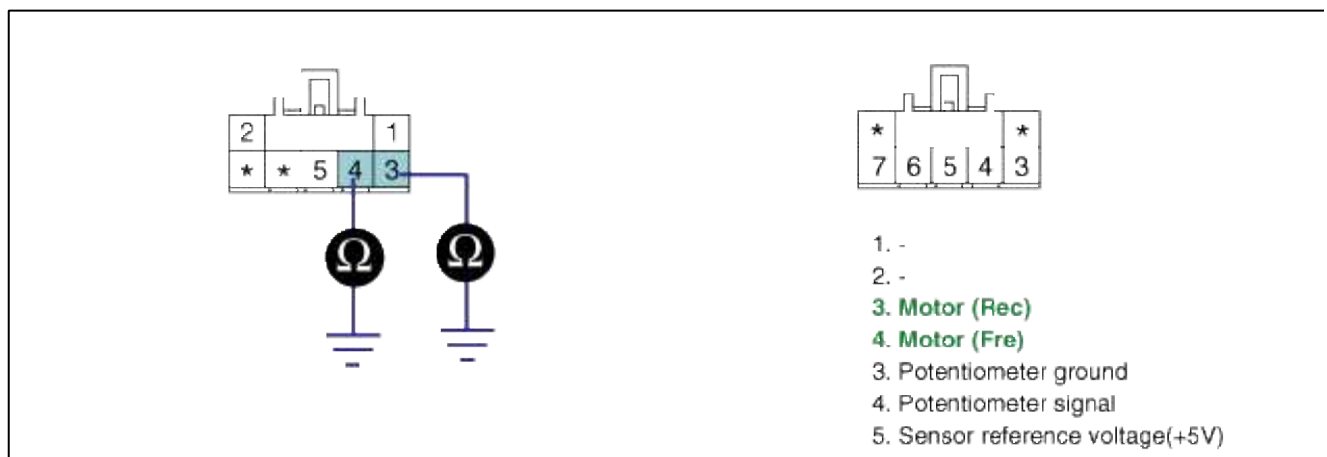
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Actuator.
- (3) Measure resistance between terminal "3,4" of Driver Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

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**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

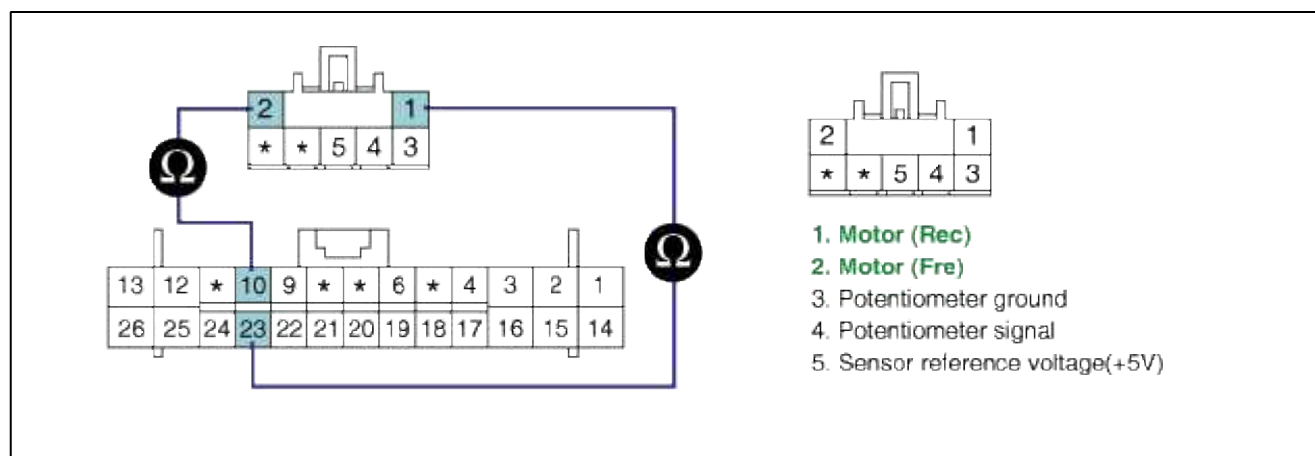
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Intake potentiometer.

(3) Measure resistance between terminal "1,2" of Intake potentiometer and terminal "23,10" of A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

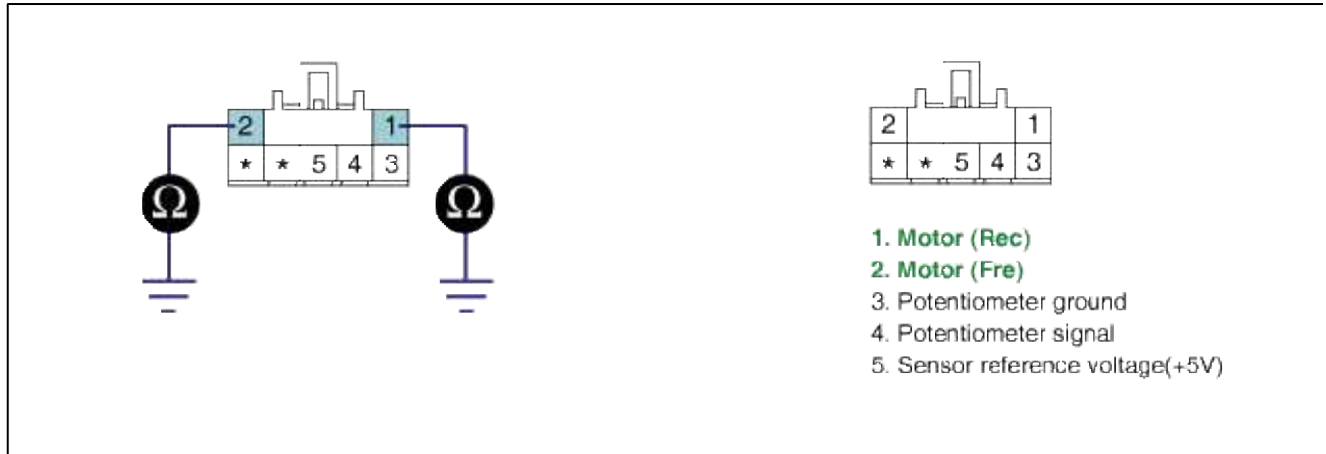
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Driver Air Mix Actuator.
- (3) Measure resistance between terminal "1,2" of Driver Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

## 1. Check actuator.

Check if Driver Air Mix Actuator works properly through ACTUATION TEST.

- (1) Ignition : ON
- (2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

1.3 ACTUATION TEST	
DRIVER AIR MIX DOOR - DRIVE 50%	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE RUNNING
PRESS [STRT], IF YOU ARE READY!	
STRT	STOP

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Intake Actuator work properly?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

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**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

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## COMPONENT INSPECTION

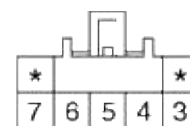
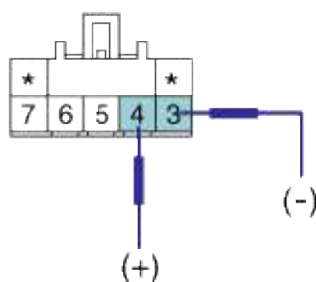
### 1. Check actuator motor.

(1) Ignition "OFF"

(2) Disconnect Intake Potentiometer.

(3) Verify that the temperature actuator operates to the fresh position when connecting 12V to the terminal "3" and grounding terminal "4".

(4) Verify that the temperature actuator operates to the recirculation position when the connections are reversed.



- 1. -
- 2. -
- 3. Motor (Rec)
- 4. Motor (Fre)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

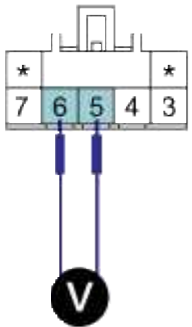
## 2. Check potentiometer

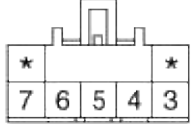
(1) Ignition "ON"

(2) Connect Intake potentiometer.

(3) Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch.

Specification : Refer the specifications





- 1. -
- 2. -
- 3. Motor (Rec)
- 4. Motor (Fre)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

Door position	Voltage (5-6)	Error detecting
Fresh	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
Recirculation	$4.7 \pm 0.15V$	High voltage : 4.9V or more

Specifications : Voltage value of Intake potentiometer as a function of position of Intake.

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

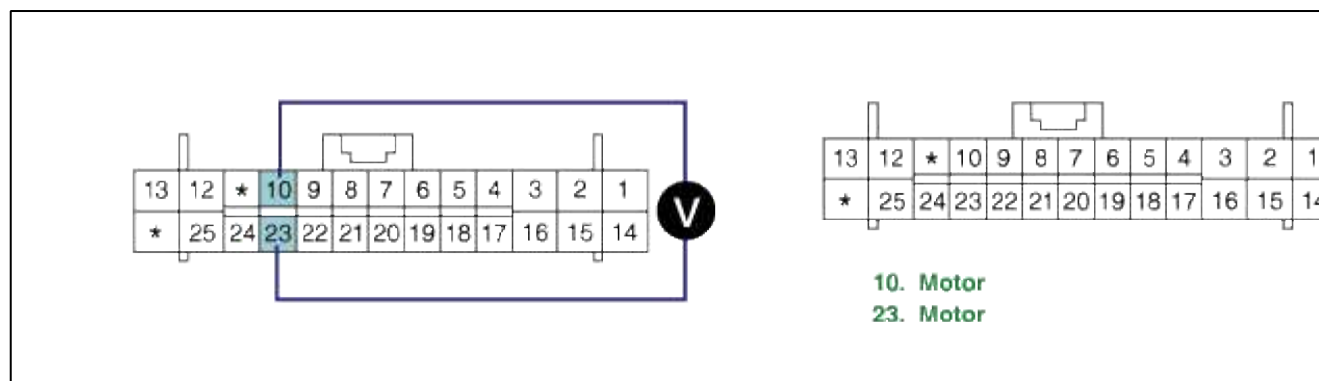
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 3. Check A/C Control Unit.

- (1) Engine "ON"
- (2) Connect A/C Control Unit.
- (3) Measure voltage between terminal "10" and "23" of A/C Control Unit while operating the Intake switch.

Specification :Approx. 12V



## (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

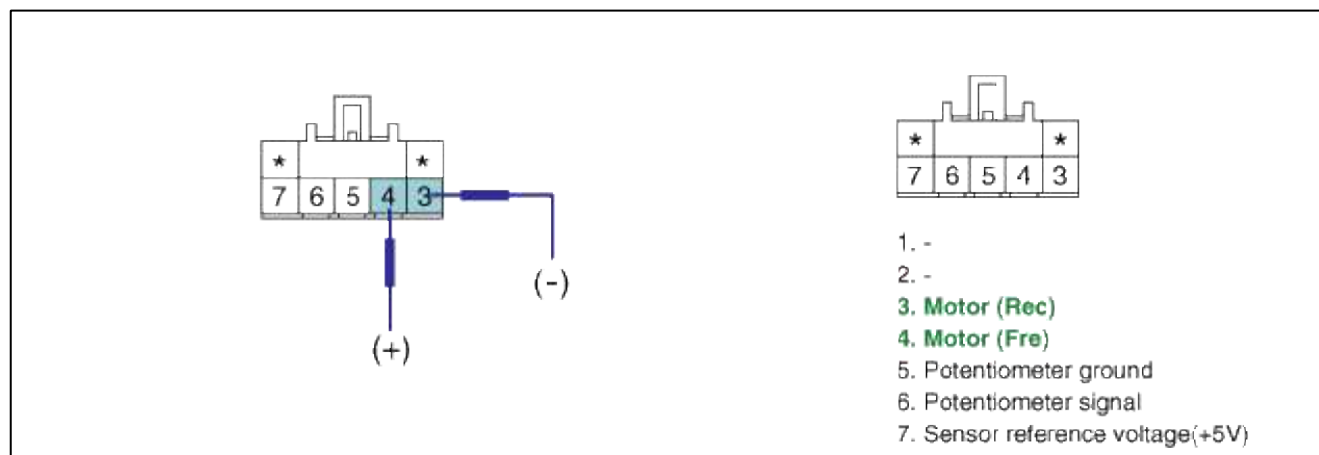
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Intake Potentiometer.
- (3) Verify that the temperature actuator operates to the fresh position when connecting 12V to the terminal "3" and grounding terminal "4".
- (4) Verify that the temperature actuator operates to the recirculation position when the connections are reversed.



(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

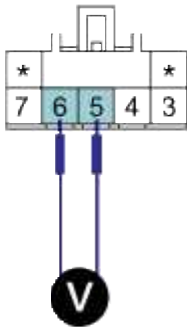
## 2. Check potentiometer

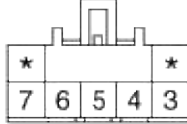
(1) Ignition "ON"

(2) Connect Intake potentiometer.

(3) Measure voltage between terminal "5" and "6" of Intake potentiometer while operating Intake switch.

Specification : Refer the specifications





- 1. -
- 2. -
- 3. Motor (Rec)
- 4. Motor (Fre)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

Door position	Voltage (5-6)	Error detecting
Fresh	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
Recirculation	$4.7 \pm 0.15V$	High voltage : 4.9V or more

Specifications : Voltage value of Intake potentiometer as a function of position of Intake.

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

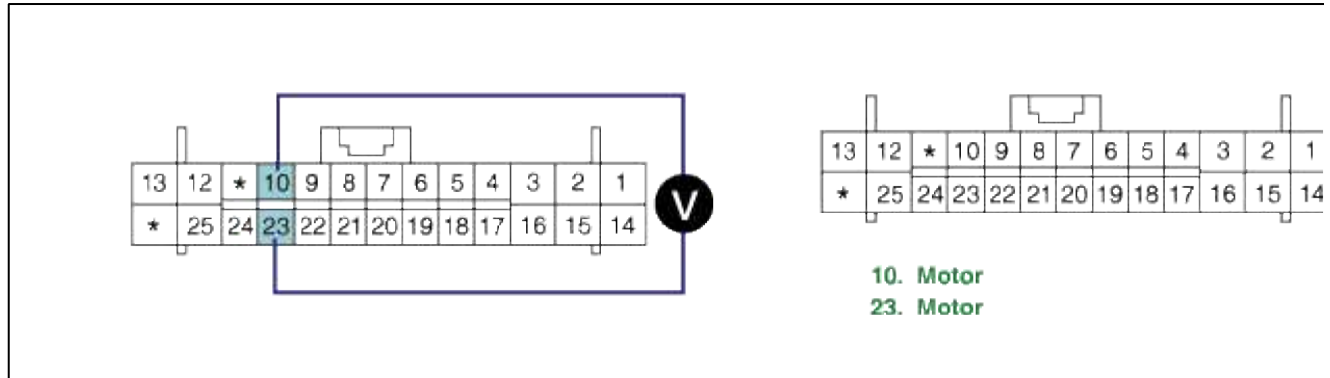
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 3. Check A/C Control Unit.

- (1) Engine "ON"
- (2) Connect A/C Control Unit.
- (3) Measure voltage between terminal "10" and "23" of A/C Control Unit while operating the Intake switch.

Specification :Approx. 12V



## (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

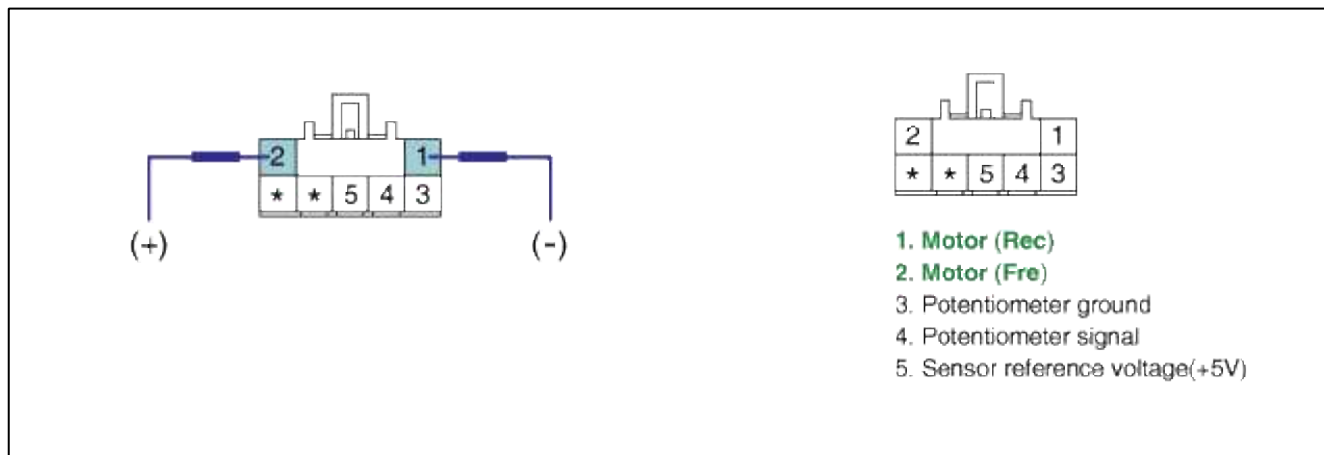
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Intake Potentiometer.
- (3) Verify that the temperature actuator operates to the fresh position when connecting 12V to the terminal "1" and grounding terminal "2".
- (4) Verify that the temperature actuator operates to the recirculation position when the connections are reversed.



(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

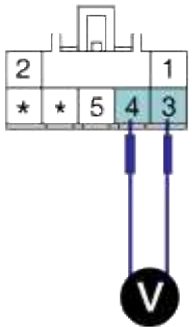
## 2. Check potentiometer

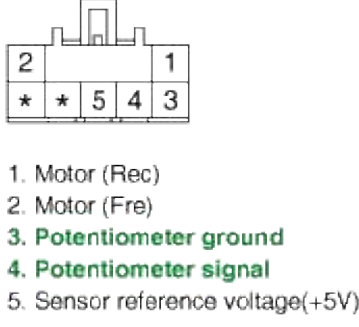
(1) Ignition "ON"

(2) Connect Intake potentiometer.

(3) Measure voltage between terminal "3" and "4" of Intake potentiometer while operating Intake switch.

Specification : Refer the specifications





Door position	Voltage (3-4)	Error detecting
Fresh	$0.3 \pm 0.15V$	Low voltage : 0.08V or less
Recirculation	$4.7 \pm 0.15V$	High voltage : 4.9V or more

Specifications : Voltage value of Intake potentiometer as a function of position of Intake.

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

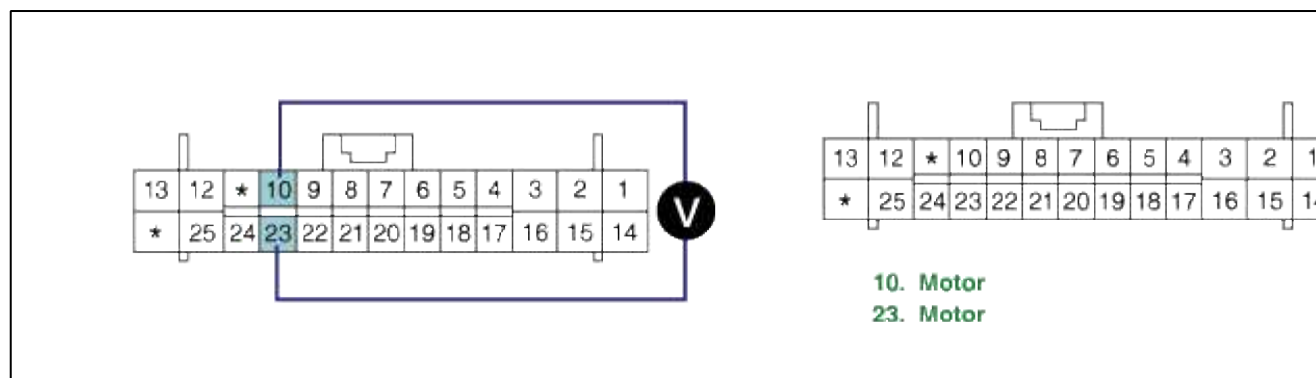
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 3. Check A/C Control Unit.

- (1) Engine "ON"
- (2) Connect A/C Control Unit.
- (3) Measure voltage between terminal "10" and "23" of A/C Control Unit while operating the Intake switch.

Specification :Approx. 12V



## (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

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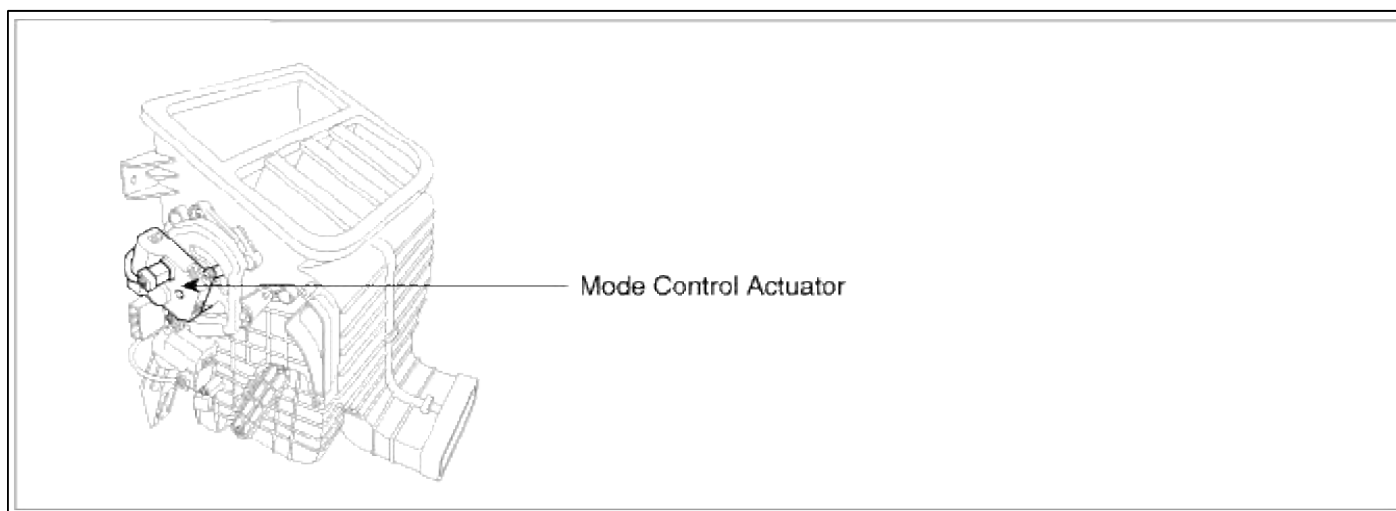
Go to the applicable troubleshooting procedure.

**NO**

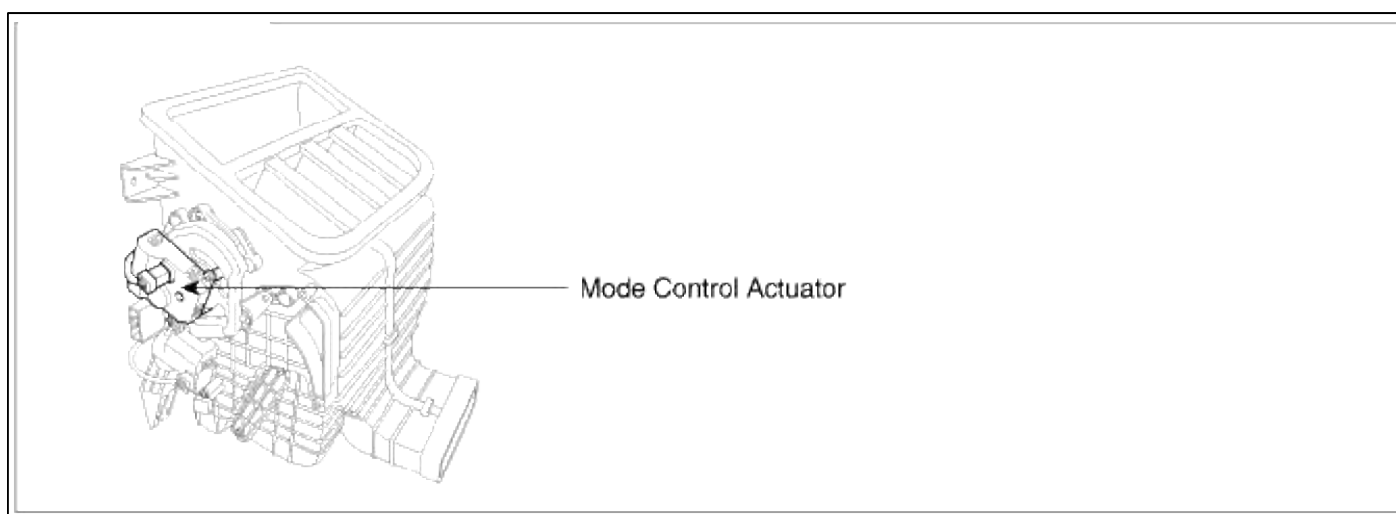
System is performing to specification at this time.

### Heating, Ventilation, Air Conditioning > Troubleshooting > B2409

#### COMPONENT LOCATION

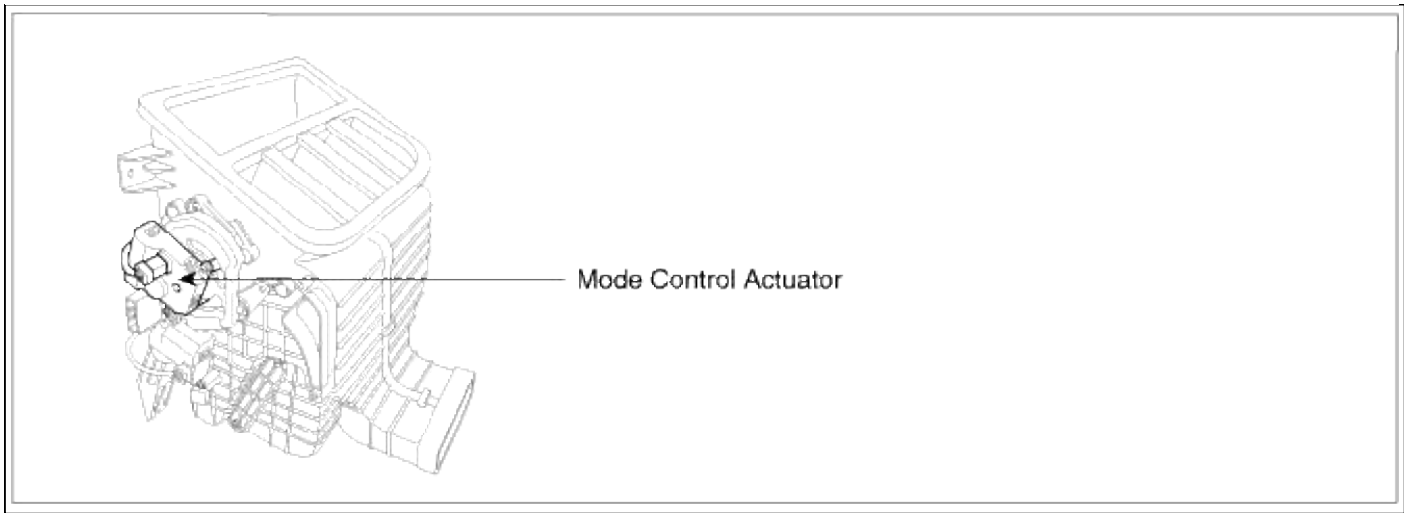


#### COMPONENT LOCATION



#### COMPONENT LOCATION





#### GENERAL DESCRIPTION

The mode control actuator mounted on heater unit, adjusts position of mode door by operating Direction Motor based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent → B/L → floor → mix.

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#### DTC DESCRIPTION

The A/C controller sets DTC B2409 if the direction motor doesn't move to intended position within 40sec(In this case, A/C controller try to move mode door for 2sec. 3 times, every 20 sec. before setting DTC).

#### DTC DESCRIPTION

The A/C controller sets DTC B2409 if the direction motor doesn't move to intended position within 40sec(In this case, A/C controller try to move mode door for 2sec. 3 times, every 20 sec. before setting DTC).

#### DTC DESCRIPTION

The A/C controller sets DTC B2409 if the direction motor doesn't move to intended position within 40sec(In this case, A/C controller try to move mode door for 2sec. 3 times, every 20 sec. before setting DTC).

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver direction potentiometer</li> <li>• Fault A/C Control Unit.</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

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Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver direction potentiometer</li> <li>• Fault A/C Control Unit.</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

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DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver direction potentiometer</li> <li>• Fault A/C Control Unit.</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"

3. Monitor the "DIRECTION POTENTIO" parameter on the scantool while operating mode switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPTENTIO.(DR.)	84.69 %
<b>DIRECTION POTENTIO</b>	<b>32.5 %</b>
PASSENGER PHOTO SENSOR	255

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B2409 DIRECTION MOTOR</b>	
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
HELP	

Fig. 2

Fig 2 : DTC B2409.

4. Are the DTC B2409 present and is parameter of "DIRECTION POTENTIO." fixed?

There is any fault in Driver Direction Motor. If the parameter of "Driver DIRECTION POTENTIO." is 10% or less on "VENT" mode, or If the parameter is 90% or more on "DEF" mode.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DIRECTION POTENTIO" parameter on the scantool while operating mode switch.

1.2 CURRENT DATA	
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DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPTENTIO.(DR.)	84.69 %
<b>DIRECTION POTENTIO</b>	<b>32.5 %</b>
PASSENGER PHOTO SENSOR	255

Fig. 1

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES	
<b>B2409 DIRECTION MOTOR</b>	
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
HELP	

Fig. 2

Fig 2 : DTC B2409.

#### 4. Are the DTC B2409 present and is parameter of "DIRECTION POTENTIO." fixed?

There is any fault in Driver Direction Motor. If the parameter of "Driver DIRECTION POTENTIO." is 10% or less on "VENT" mode, or If the parameter is 90% or more on "DEF" mode.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DIRECTION POTENTIO" parameter on the scantool while operating mode switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
AIR MIX POPENIO.(DR.)	84.69 %
<b>DIRECTION POTENIO</b>	<b>32.5 %</b>
PASSENGER PHOTO SENSOR	255

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B2409 DIRECTION MOTOR</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

Fig 2 : DTC B2409.

#### 4. Are the DTC B2409 present and is parameter of "DIRECTION POTENTIO." fixed?

There is any fault in Driver Direction Motor. If the parameter of "Driver DIRECTION POTENTIO." is 10% or less on "VENT" mode, or If the parameter is 90% or more on "DEF" mode.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

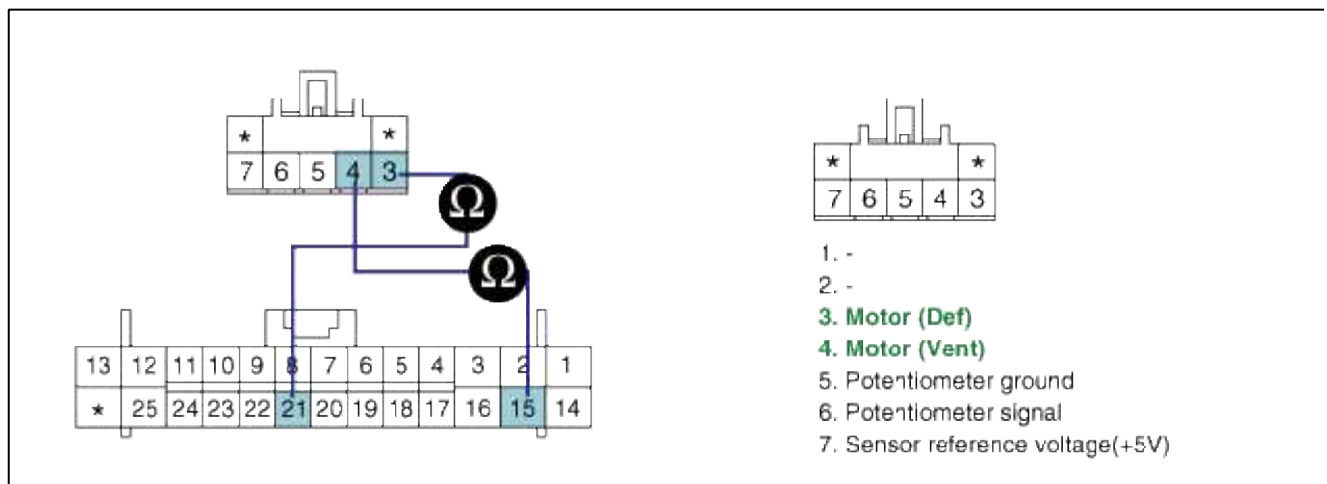
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "3,4" of Direction Motor and terminal "21,15" of A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

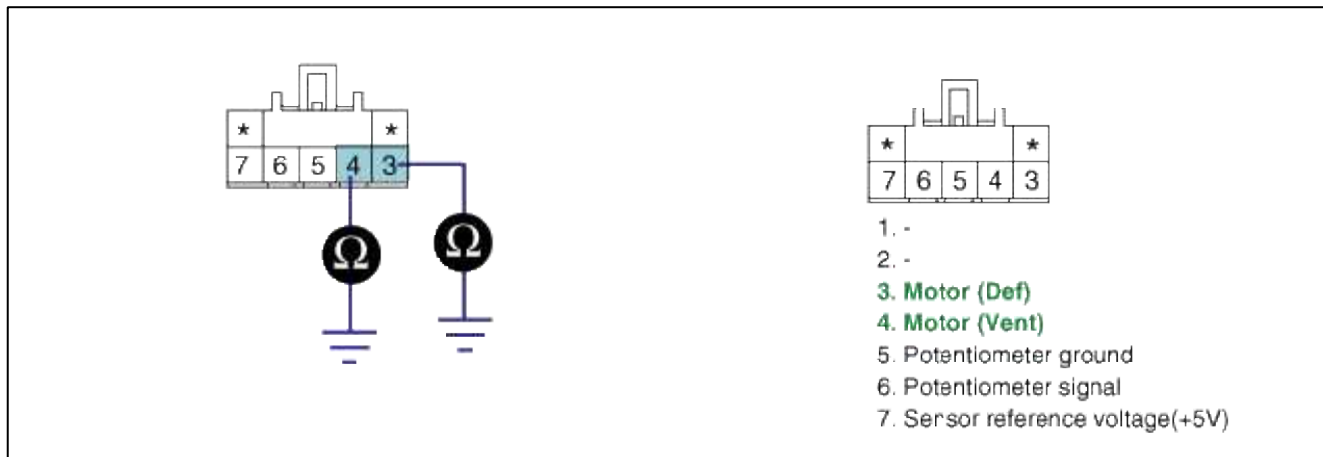
2. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "3,4" of Direction Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

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Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

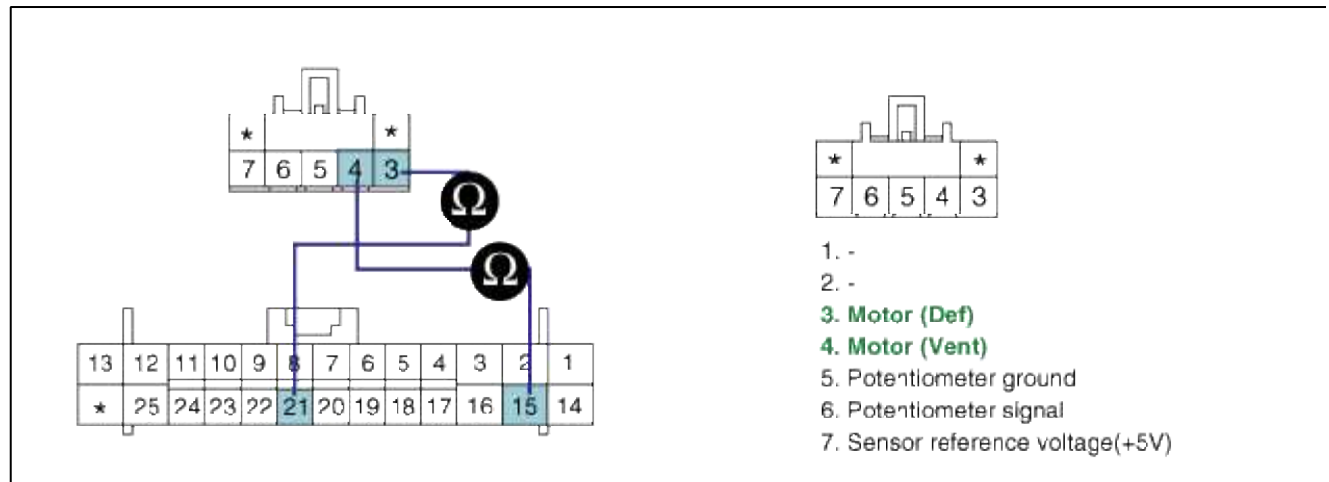
**NO**

Go to "Signal circuit inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
  - (1) Ignition "OFF"
  - (2) Disconnect mode Actuator.
  - (3) Measure resistance between terminal "3,4" of Direction Motor and terminal "21,15" of A/C control unit.

Specification : Approx. 0  $\Omega$



- (4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

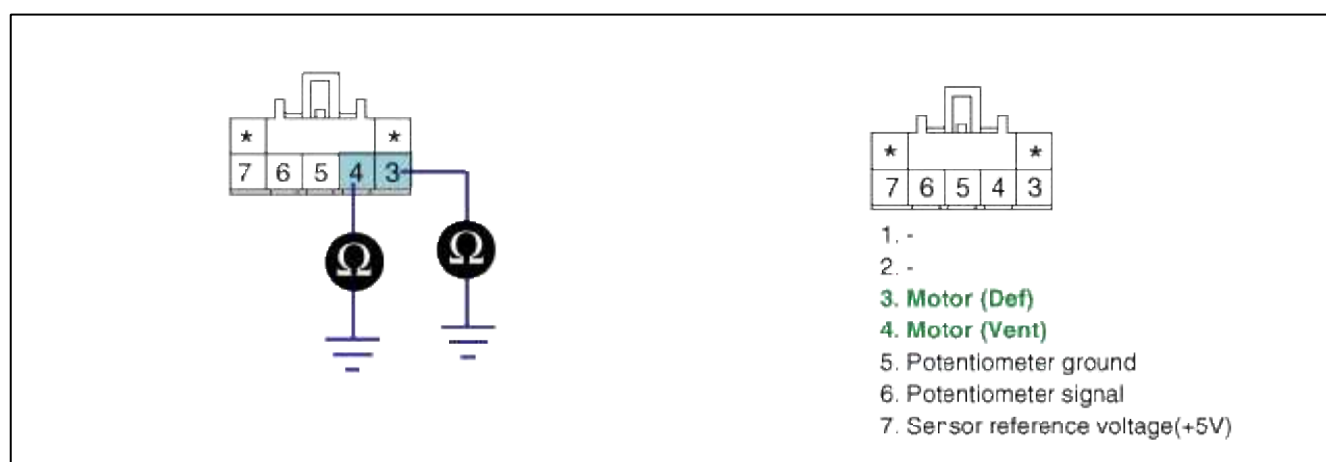
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect mode Actuator.
- (3) Measure resistance between terminal "3,4" of Direction Motor and chassis ground.

Specification : Approx.  $\infty$   $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

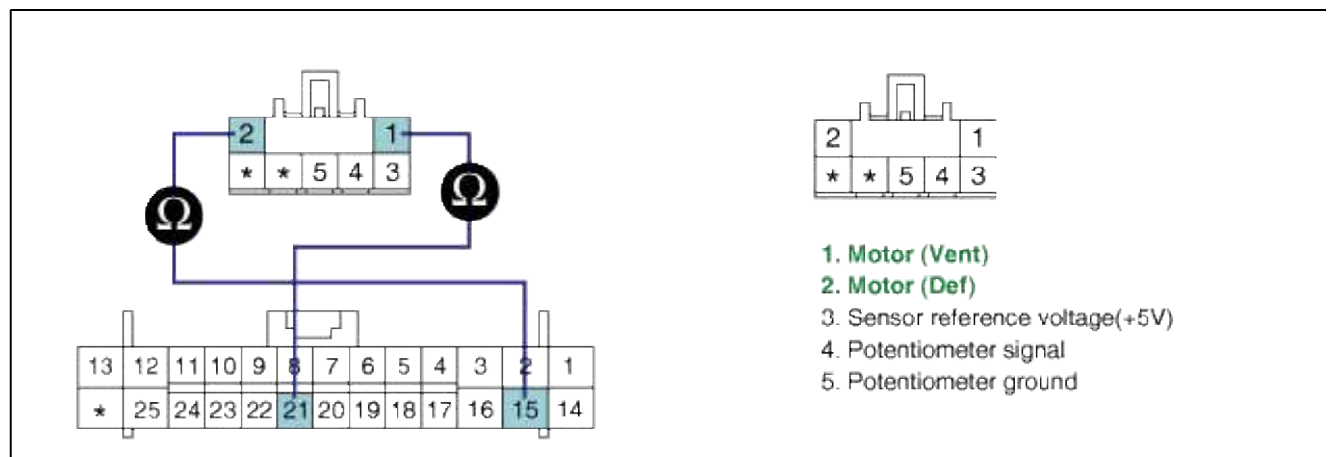
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect mode Actuator.

(3) Measure resistance between terminal "1,2" of Direction Motor and terminal "21,15" of A/C control unit.

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

**NO**

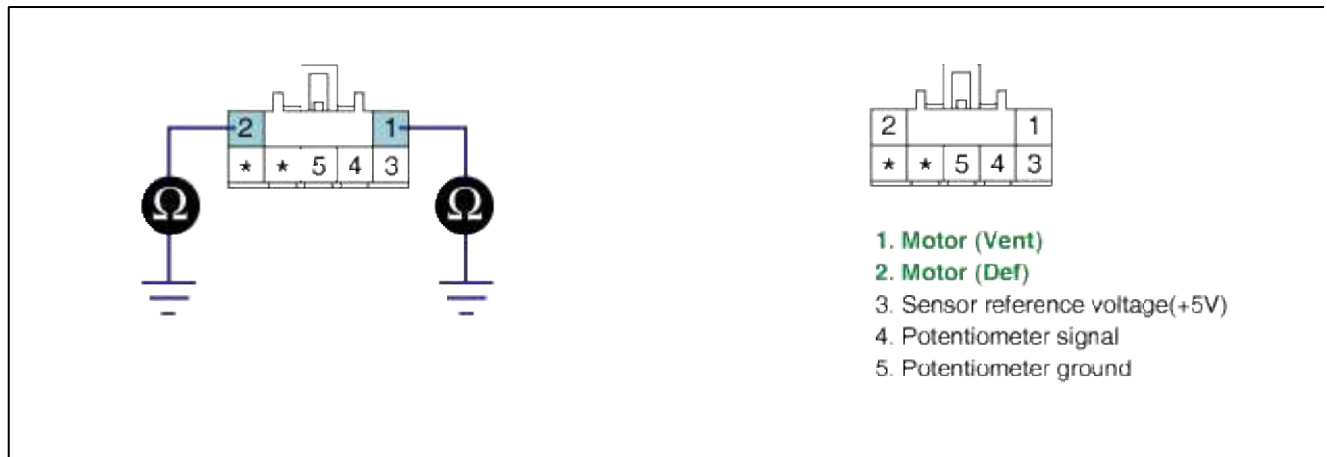
Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.



## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect mode Actuator.
- (3) Measure resistance between terminal "1,2" of Direction Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

## 1. Check actuator.

Check if Direction Actuator works properly through ACTUATION TEST.

- (1) Ignition : ON
- (2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

1.3 ACTUATION TEST	
DRIVER AIR OUTLET MODE-DRIVE FOOT	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE RUNNING
PRESS [STRT], IF YOU ARE READY!	
[STRT]	[STOP]

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Direction Actuator work properly?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

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STRT	STOP

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Direction Actuator work properly?

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**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

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Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

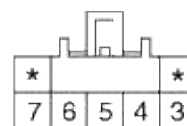
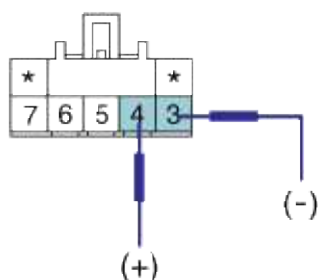
## 1. Check actuator.

(1) Ignition "OFF"

(2) Disconnect Direction potentiometer.

(3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal "3" and groundi terminal "4".

(4) Verify that the mode actuator operates to the def mode when the connections are reversed.



1. -
2. -
3. Motor (Def)
4. Motor (Vent)
5. Potentiometer ground
6. Potentiometer signal
7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

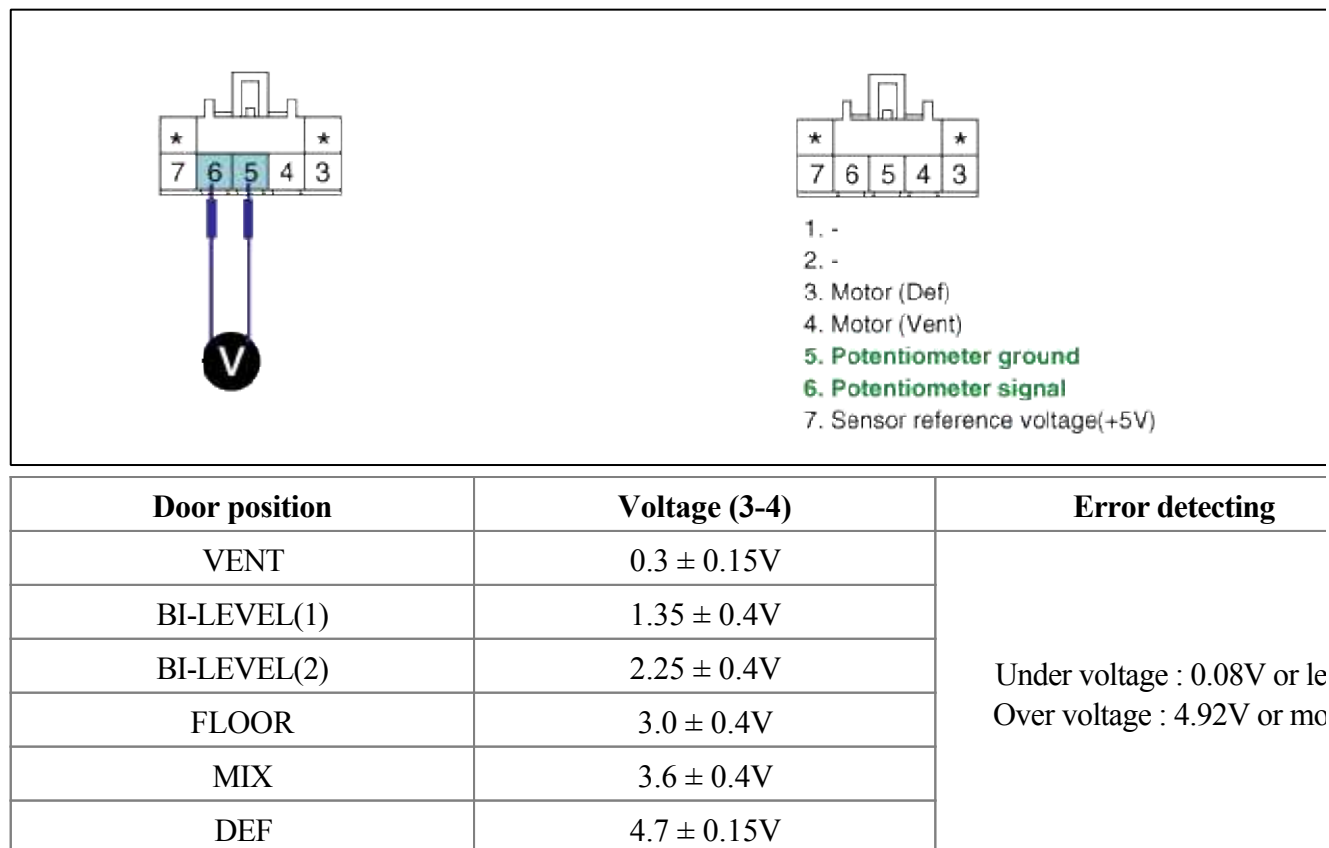
## 2. Check potentiometer

(1) Ignition "ON"

(2) Connect Direction potentiometer.

(3) Measure voltage between terminal "3" and "4" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



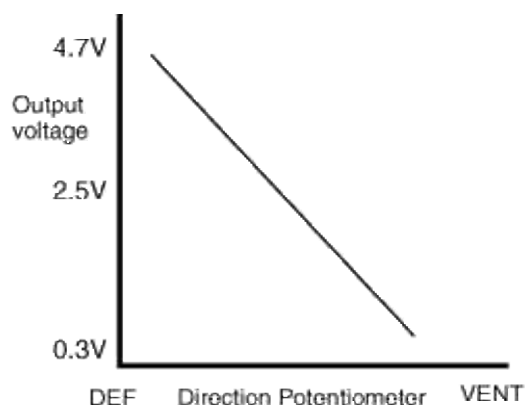
**Fig. 3**

Fig 3) Specifications : Voltage value as a function of position of direction potentiometer.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace it and then go to "Verification of Vehicle Repair" procedure.

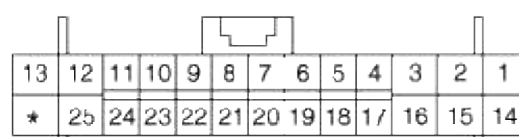
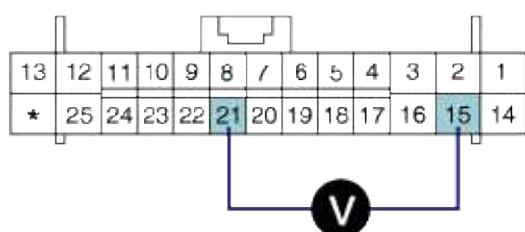
3. Check A/C Control Unit.

(1) Engine : "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "15" and "21" of A/C Control Unit while operating the mode switch.

Specification : Approx. 12V



15. Motor  
21. Motor

(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

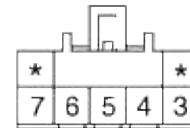
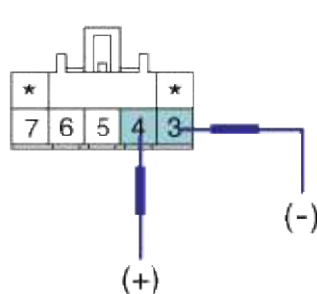
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

## 1. Check actuator.

- (1) Ignition "OFF"
- (2) Disconnect Direction potentiometer.
- (3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal "3" and groundi terminal "4".
- (4) Verify that the mode actuator operates to the def mode when the connections are reversed.



1. -
2. -
3. **Motor (Def)**
4. **Motor (Vent)**
5. Potentiometer ground
6. Potentiometer signal
7. Sensor reference voltage(+5V)

## (5) Does the actuator work properly?

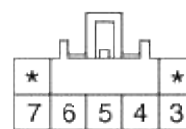
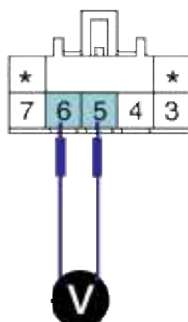
Go to "Check potentiometer" procedure.

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

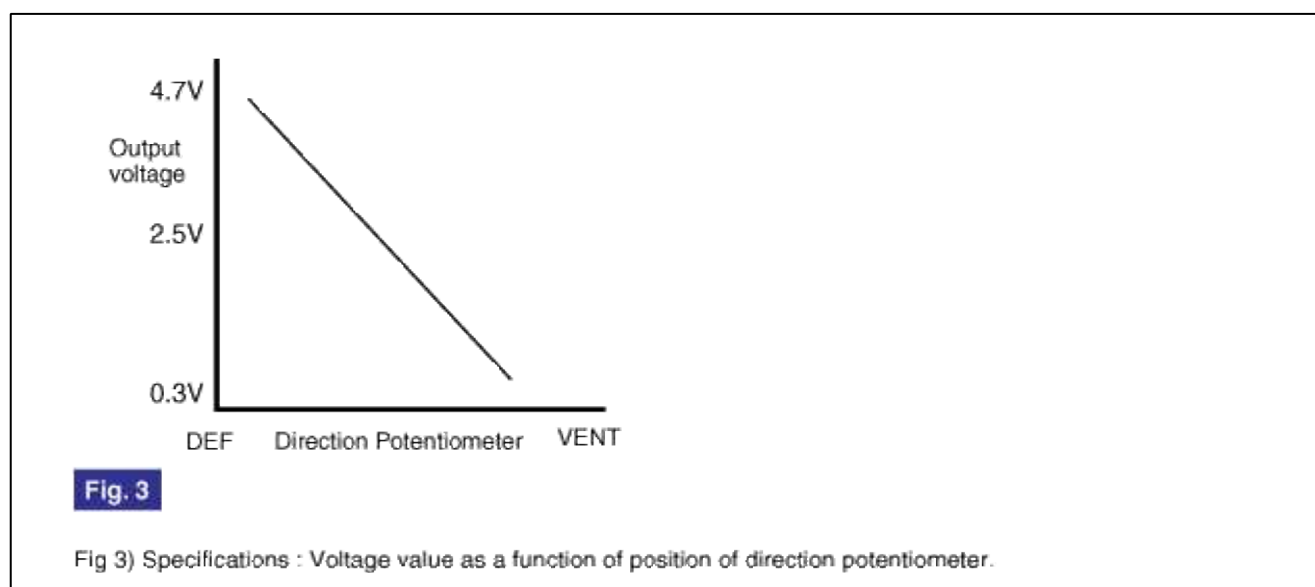
- (1) Ignition "ON"
- (2) Connect Direction potentiometer.
- (3) Measure voltage between terminal "3" and "4" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



1. -
2. -
3. **Motor (Def)**
4. **Motor (Vent)**
5. **Potentiometer ground**
6. **Potentiometer signal**
7. Sensor reference voltage(+5V)

Door position	Voltage (3-4)	Error detecting
VENT	$0.3 \pm 0.15V$	Under voltage : 0.08V or le Over voltage : 4.92V or mo
BI-LEVEL(1)	$1.35 \pm 0.4V$	
BI-LEVEL(2)	$2.25 \pm 0.4V$	
FLOOR	$3.0 \pm 0.4V$	
MIX	$3.6 \pm 0.4V$	
DEF	$4.7 \pm 0.15V$	



(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace the actuator and then go to "Verification of Vehicle Repair" procedure.

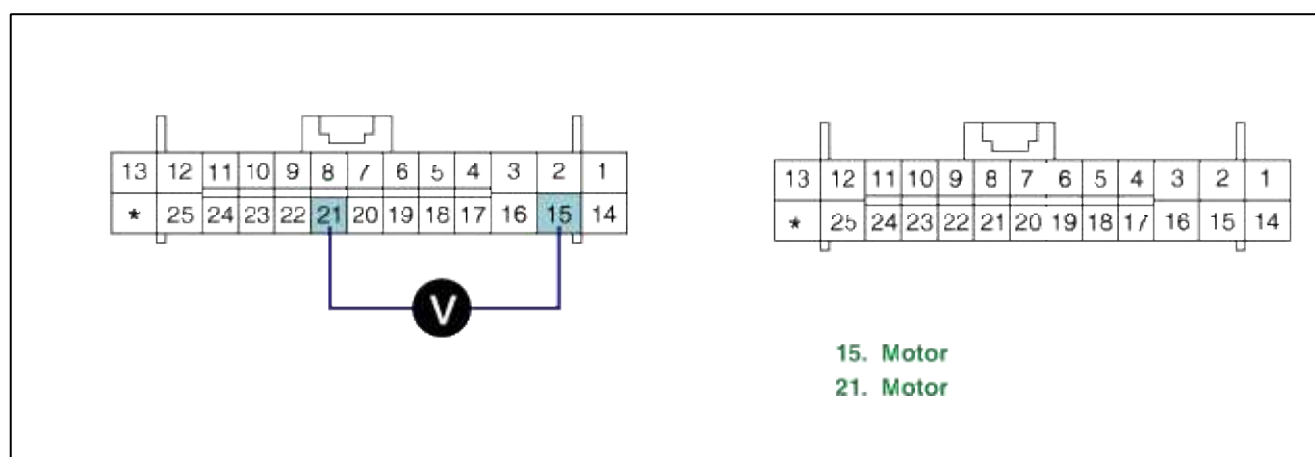
3. Check A/C Control Unit.

(1) Engine : "ON"

(2) Connect A/C Control Unit.

- (3) Measure voltage between terminal "15" and "21" of A/C Control Unit while operating the mode switch.

Specification :Approx. 12V



- (4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

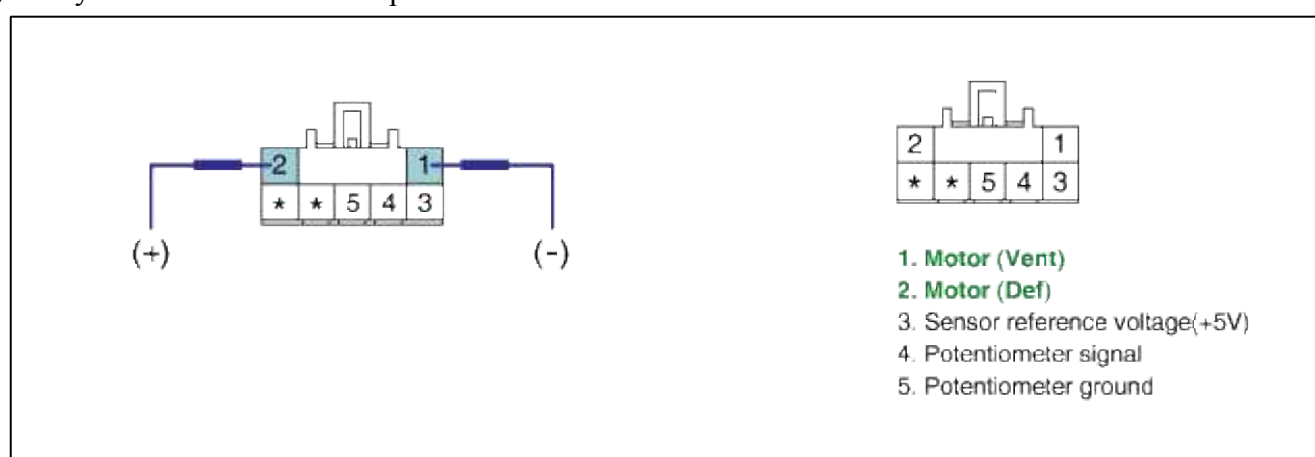
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

### 1. Check actuator.

- (1) Ignition "OFF"
- (2) Disconnect Direction potentiometer.
- (3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal "1" and ground to terminal "2".
- (4) Verify that the mode actuator operates to the def mode when the connections are reversed.



- (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

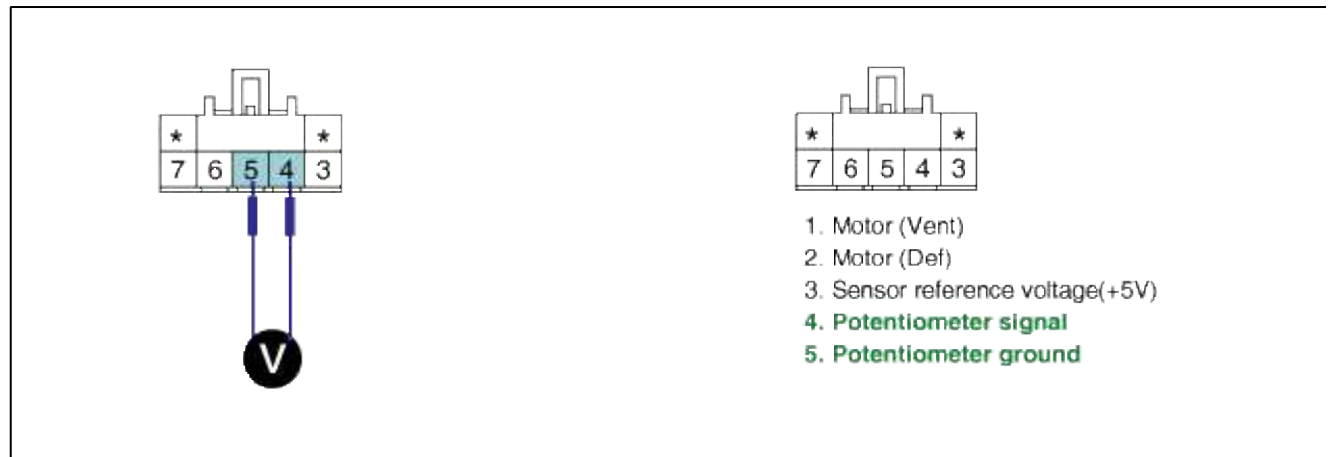
Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.



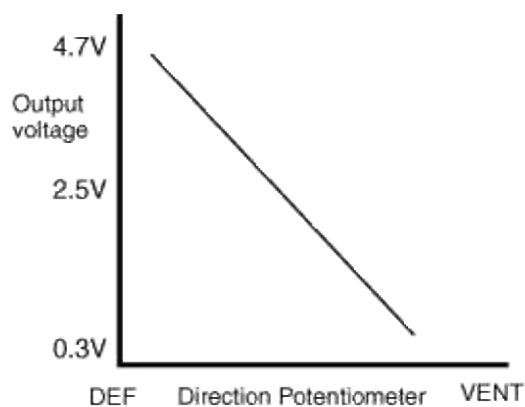
## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Direction potentiometer.
- (3) Measure voltage between terminal "4" and "5" of Direction potentiometer as the mode switch is operated.

Specification : Refer the specifications in fig 3



Door position	Voltage (4-5)	Error detecting
VENT	$0.3 \pm 0.15V$	Under voltage : 0.08V or le Over voltage : 4.92V or mo
BI-LEVEL(1)	$1.35 \pm 0.4V$	
BI-LEVEL(2)	$2.25 \pm 0.4V$	
FLOOR	$3.0 \pm 0.4V$	
MIX	$3.6 \pm 0.4V$	
DEF	$4.7 \pm 0.15V$	



**Fig. 3**

Fig 3) Specifications : Voltage value as a function of position of direction potentiometer.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

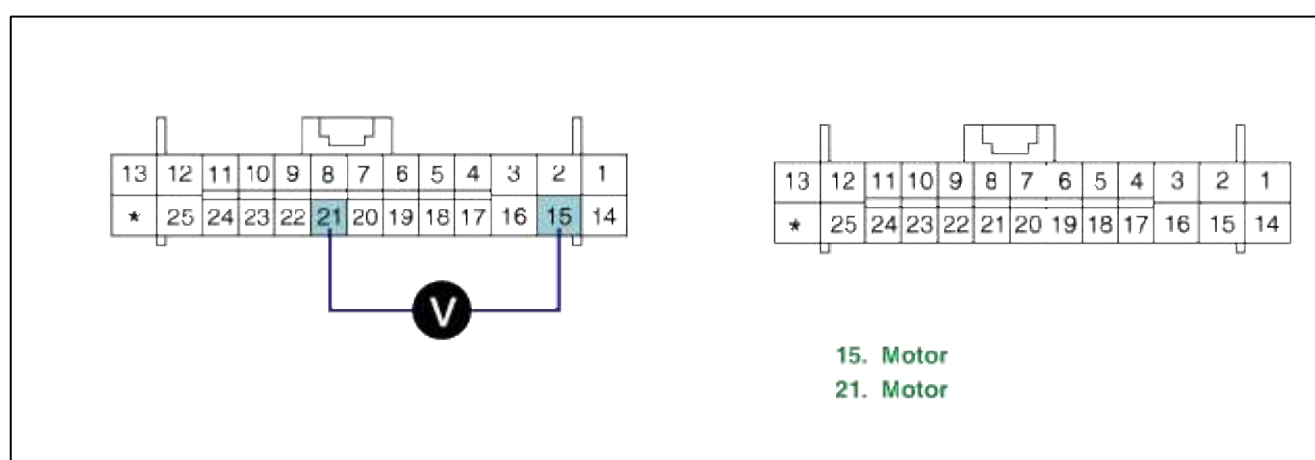
### 3. Check A/C Control Unit.

(1) Engine : "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "15" and "21" of A/C Control Unit while operating the mode switch.

Specification :Approx. 12V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

### VERIFICATION OF VEHICLE REPAIR

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1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
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3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

#### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

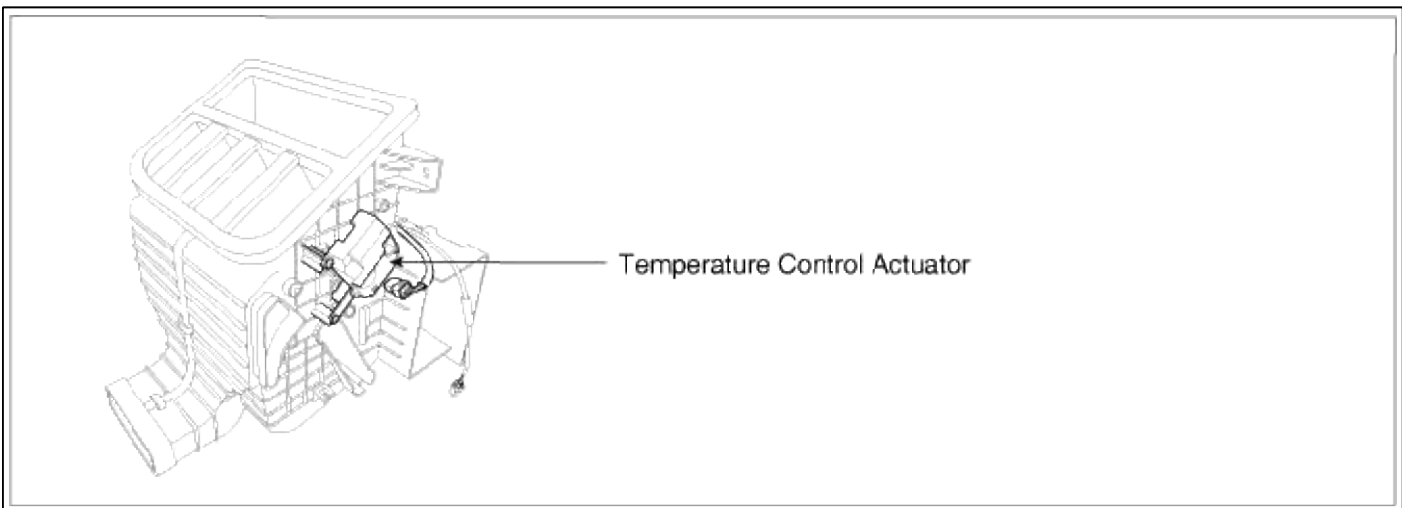
Go to the applicable troubleshooting procedure.

**NO**

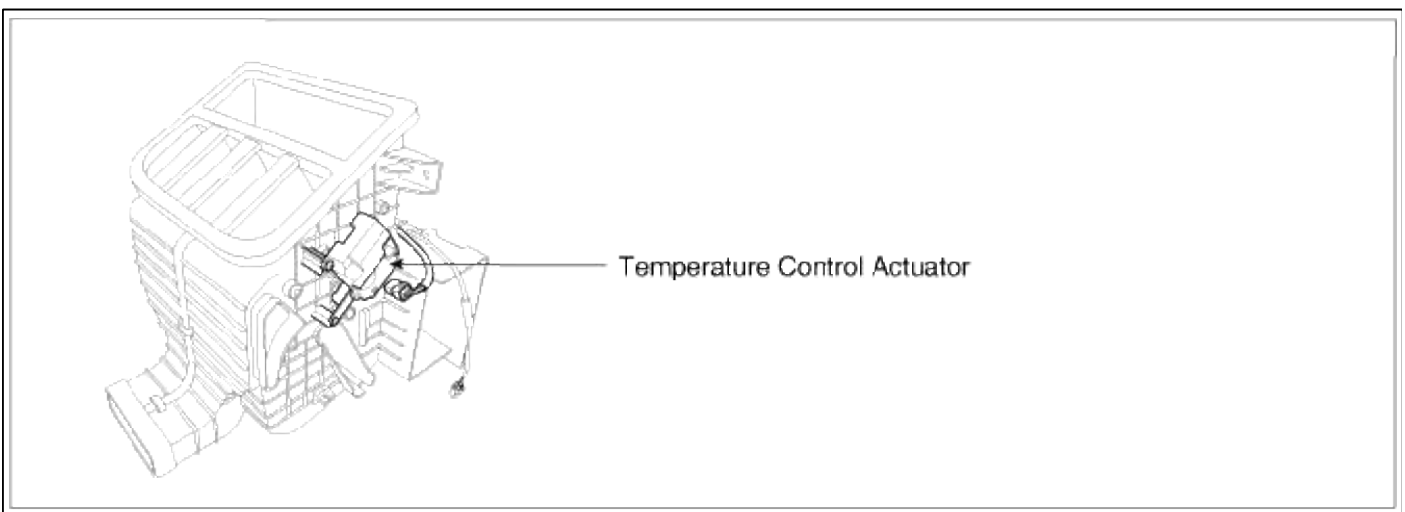
System is performing to specification at this time.

### Heating,Ventilation, Air Conditioning > Troubleshooting > B2415

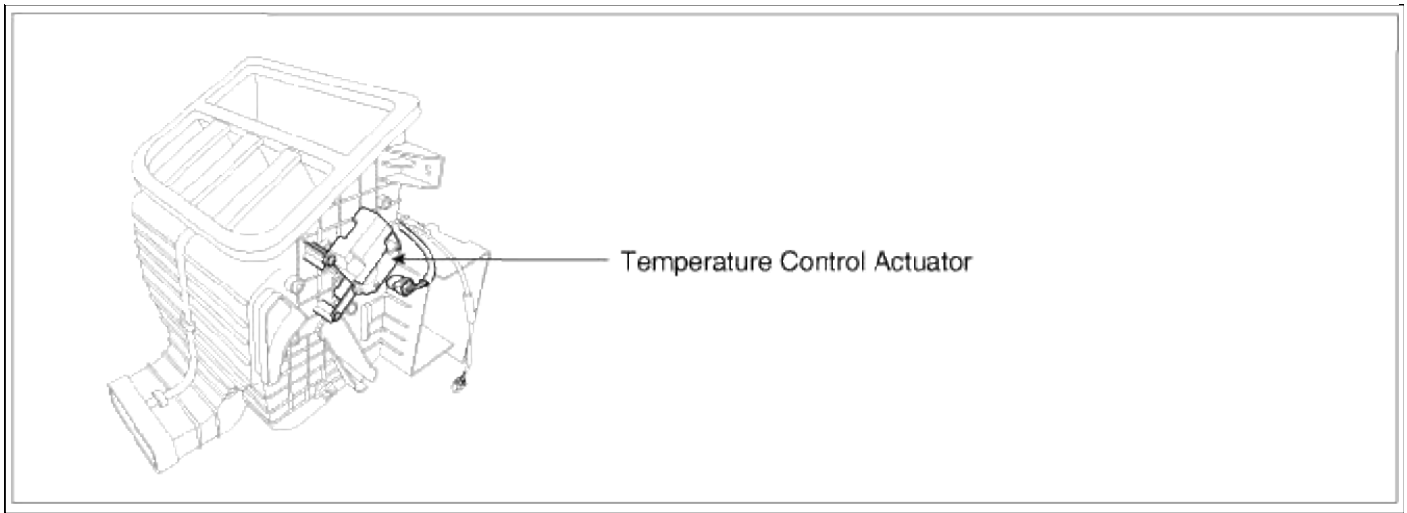
#### COMPONENT LOCATION



#### COMPONENT LOCATION



#### COMPONENT LOCATION



#### GENERAL DESCRIPTION

Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

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Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

#### DTC DESCRIPTION

The A/C controller sets DTC B2415 if the air mix actuator doesn't move to intended position within 40sec (In this case, A/C controller try to move temp. door for 2sec. 3 times, every 20 sec. before setting DTC).

#### DTC DESCRIPTION

The A/C controller sets DTC B2415 if the air mix actuator doesn't move to intended position within 40sec (In this case, A/C controller try to move temp. door for 2sec. 3 times, every 20 sec. before setting DTC).

#### DTC DESCRIPTION

The A/C controller sets DTC B2415 if the air mix actuator doesn't move to intended position within 40sec (In this case, A/C controller try to move temp. door for 2sec. 3 times, every 20 sec. before setting DTC).

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> <li>• Fault A/C Control Unit</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> <li>• Fault A/C Control Unit</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

## DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	<ul style="list-style-type: none"> <li>• Poor connection of connected part</li> <li>• Open circuit in harness</li> <li>• Short circuit in harness</li> <li>• Faulty driver Air Mix potentiometer</li> <li>• Fault A/C Control Unit</li> </ul>
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"

3. Monitor the "Passenger Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	14.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	13.0 °C	■
DRIVER PHOTO SENSOR	0.00 V	
<b>AIR MIX POPENIO.(PA.)</b>	<b>22.7 %</b>	
DIRECTION POTENIO.DR.	51.76 %	
PASSENGER PHOTO SENSOR	255	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B2415.

1.1 DIAGNOSTIC TROUBLE CODES		
<b>B2415 PASSENGER AIR MIX MOTOR</b>		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div></div> <div>HELP</div> </div>		

Fig. 2

4. Are the DTC B2415 present and is parameter of "Passenger AIR MIX Potentiometer" fixed?

There is any fault in Passenger AIR MIX Motor. If the parameter of "Passenger AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Passenger Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA		
HEATER WATER TEMP.SNSR	14.0 °C	▲
IN-CAR TEMP.SENSOR	12.0 °C	
AMBIENT AIR TEMP.SNS	12.0 °C	
EVAPORATIVE SENSOR	13.0 °C	■
DRIVER PHOTO SENSOR	0.00 V	
<b>AIR MIX POPENIO.(PA.)</b>	<b>22.7 %</b>	
DIRECTION POTENIO.DR.	51.76 %	
PASSENGER PHOTO SENSOR	255	▼
<div> <div>FIX</div> <div>SCRN</div> <div>FULL</div> <div>PART</div> <div>GRPH</div> <div>HELP</div> </div>		

Fig. 1

Fig 1 : The current data in abnormal state.

Fig 2 : DTC B2415.

1.1 DIAGNOSTIC TROUBLE CODES		
<b>B2415 PASSENGER AIR MIX MOTOR</b>		
NUMBER OF DTC : 1 ITEMS		
<div> <div>PART</div> <div>ERAS</div> <div></div> <div>HELP</div> </div>		

Fig. 2

#### 4. Are the DTC B2415 present and is parameter of "Passenger AIR MIX Potentiometer" fixed?

There is any fault in Passenger AIR MIX Motor. If the parameter of "Passenger AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

#### MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Passenger Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

1.2 CURRENT DATA	
HEATER WATER TEMP.SNSR	14.0 °C
IN-CAR TEMP.SENSOR	12.0 °C
AMBIENT AIR TEMP.SNS	12.0 °C
EVAPORATIVE SENSOR	13.0 °C
DRIVER PHOTO SENSOR	0.00 V
<b>AIR MIX POPENIO.(PA.)</b>	<b>22.7 %</b>
DIRECTION POTENIO.DR.	51.76 %
PASSENGER PHOTO SENSOR	255

**Fig. 1**

Fig 1 : The current data in abnormal state.

1.1 DIAGNOSTIC TROUBLE CODES
<b>B2415 PASSENGER AIR MIX MOTOR</b>
NUMBER OF DTC : 1 ITEMS

**Fig. 2**

Fig 2 : DTC B2415.

#### 4. Are the DTC B2415 present and is parameter of "Passenger AIR MIX Potentiometer" fixed?

There is any fault in Passenger AIR MIX Motor. If the parameter of "Passenger AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position.

**YES**

Go to "Inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.  
Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

### SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.

(1) Ignition "OFF"

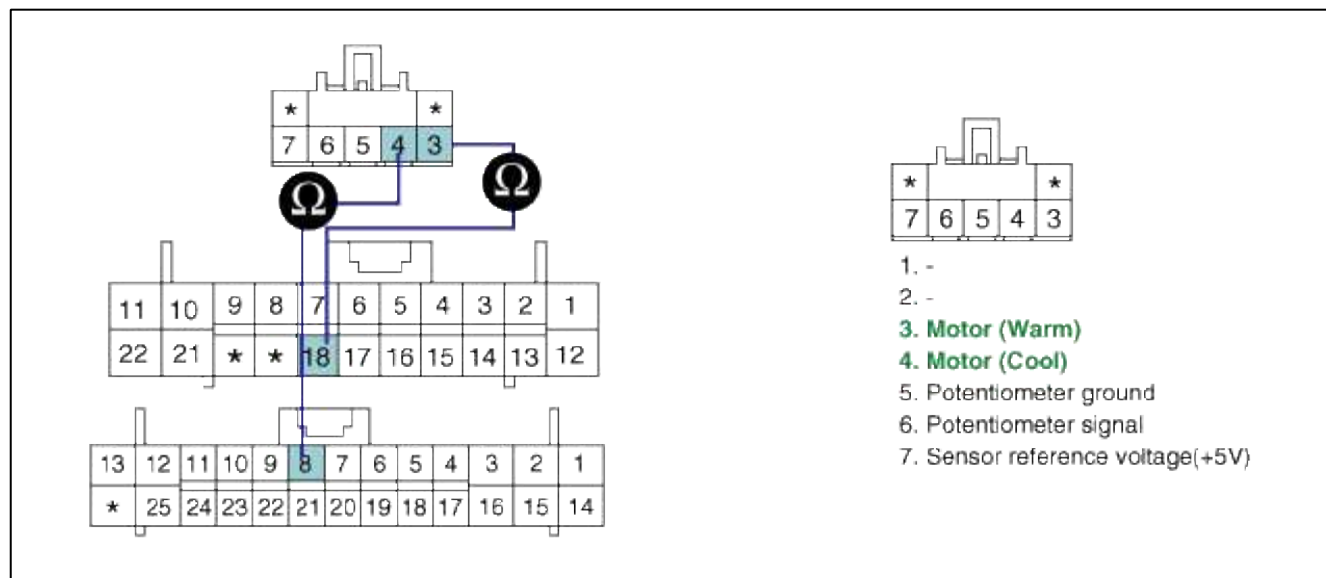
(2) Disconnect Passenger Air Mix potentiometer.

(3) Measure resistance between terminal "3,4" of Passenger Air Mix Motor and terminal "18,8" of A/C control un

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Specification : Approx.  $0\ \Omega$

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(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

**NO**

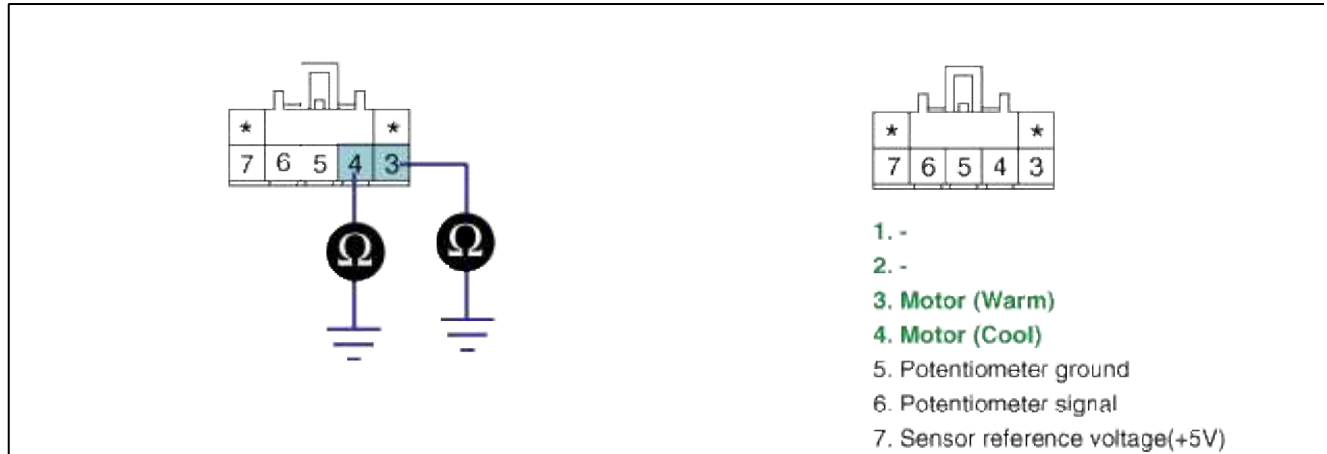
Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.



## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Passenger Air Mix Actuator.
- (3) Measure resistance between terminal "3,4" of Passenger Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

## 1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

## 2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## 3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

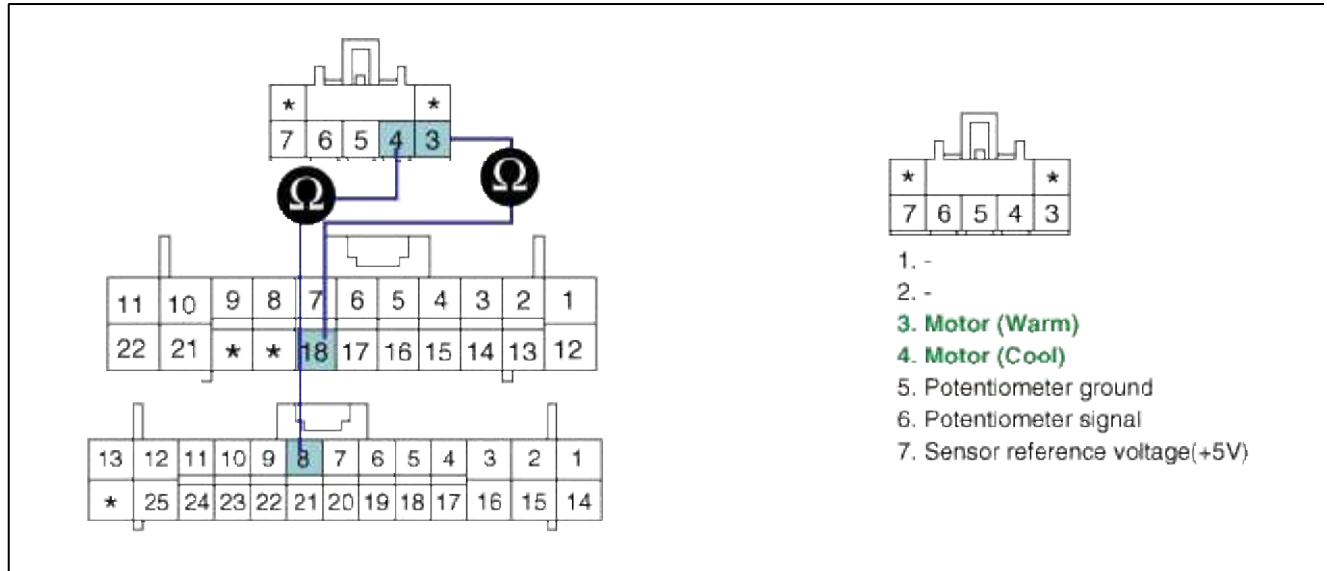
Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

## 1. Check for open in harness.

- (1) Ignition "OFF"
- (2) Disconnect Passenger Air Mix potentiometer.
- (3) Measure resistance between terminal "3,4" of Passenger Air Mix Motor and terminal "18,8" of A/C control un

Specification : Approx. 0  $\Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

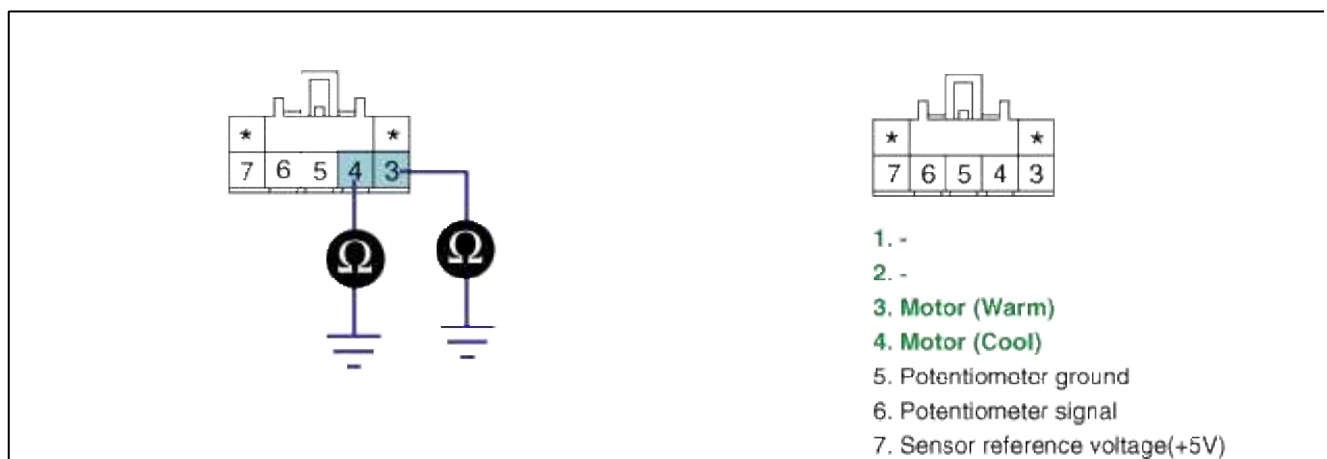
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Passenger Air Mix Actuator.
- (3) Measure resistance between terminal "3,4" of Passenger Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection " procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Signal circuit inspection" procedure.

## SIGNAL CIRCUIT INSPECTION

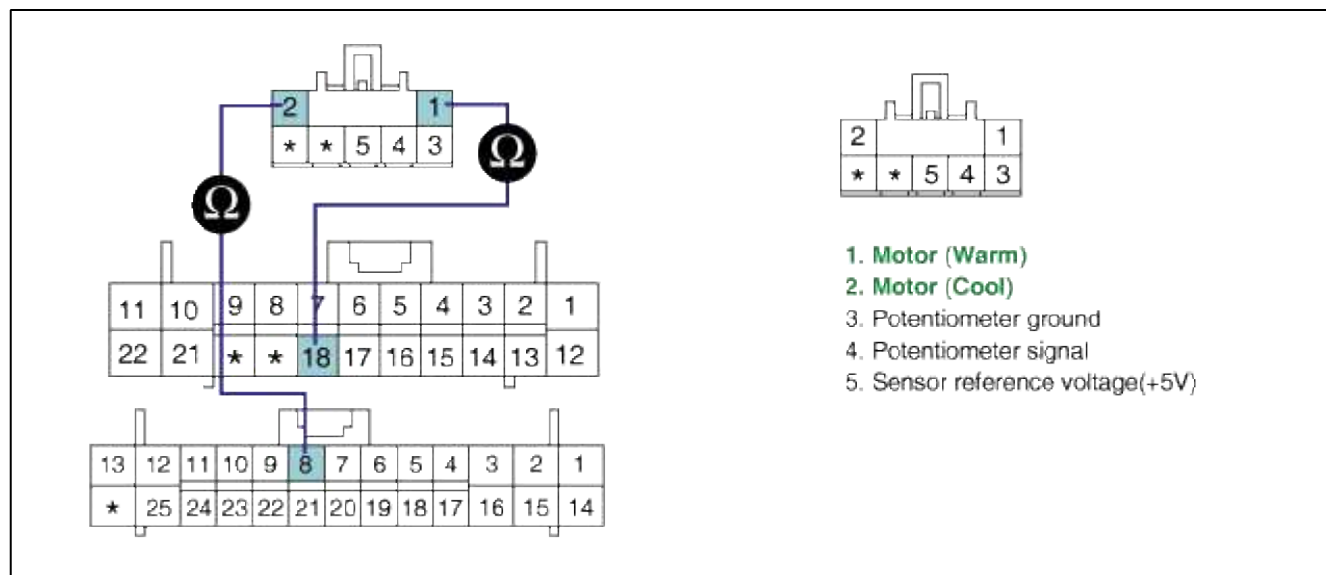
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Passenger Air Mix potentiometer.

(3) Measure resistance between terminal "1,2" of Passenger Air Mix Motor and terminal "18,8" of A/C control un

Specification : Approx. 0  $\Omega$



(4) Is the measured resistance within specifications?

**YES**

Go to "Check for short to ground in harness" procedure.

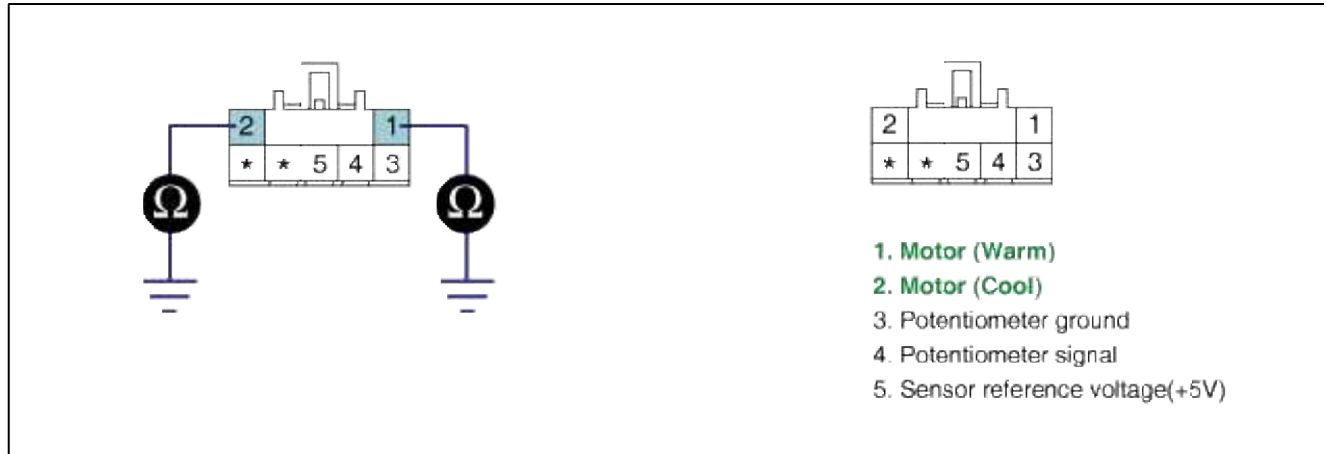
**NO**

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## 2. Check for short to ground in harness.

- (1) Ignition "OFF"
- (2) Disconnect Passenger Air Mix Actuator.
- (3) Measure resistance between terminal "1,2" of Passenger Air Mix Motor and chassis ground.

Specification : Approx.  $\infty \Omega$



## (4) Is the measured resistance within specifications?

**YES**

Go to "Visual/Physical Inspection" procedure.

**NO**

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

## 1. Check actuator.

Check if Passenger Air Mix Actuator works properly through ACTUATION TEST.

- (1) Ignition : ON
- (2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

1.3 ACTUATION TEST	
PASSENGER AIR MIX DOOR - PASSENGER 50%	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE RUNNING
PRESS [STRT], IF YOU ARE READY!	
STRT	STOP

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Passenger Air Mix Actuator work properly?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

### 1. Check actuator.

Check if Passenger Air Mix Actuator works properly through ACTUATION TEST.

(1) Ignition : ON

(2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

1.3 ACTUATION TEST	
PASSENGER AIR MIX DOOR - PASSENGER 50%	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE RUNNING
PRESS [STRT], IF YOU ARE READY!	
<b>STRT</b>	<b>STOP</b>

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Passenger Air Mix Actuator work properly?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## VISUAL/PHYSICAL INSPECTION

## 1. Check actuator.

Check if Passenger Air Mix Actuator works properly through ACTUATION TEST.

(1) Ignition : ON

(2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

1.3 ACTUATION TEST	
PASSENGER AIR MIX DOOR - PASSENGER 50%	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE RUNNING
PRESS [STRT], IF YOU ARE READY!	
STRT	STOP

**Fig. 3**

Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Does Passenger Air Mix Actuator work properly?

**YES**

Go to "Component Inspection" procedure.

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

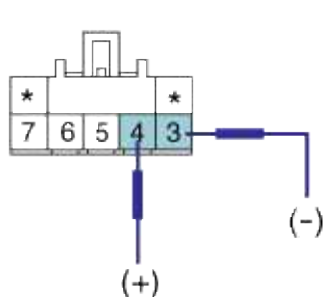
## 1. Check actuator motor.

(1) Ignition "OFF"

(2) Disconnect Passenger Air Mix Potentiometer.

(3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".

(4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



- 1. -
- 2. -
- 3. Motor (Warm)
- 4. Motor (Cool)
- 5. Potentiometer ground
- 6. Potentiometer signal
- 7. Sensor reference voltage(+5V)

(5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

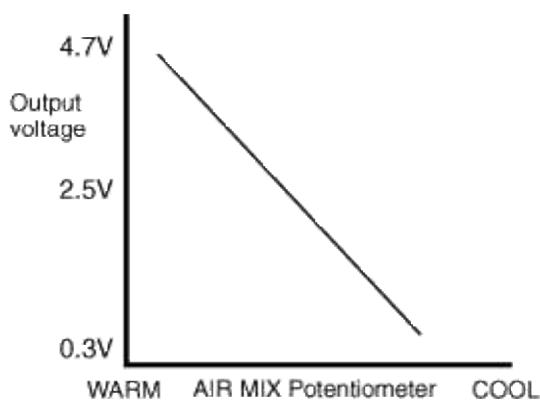
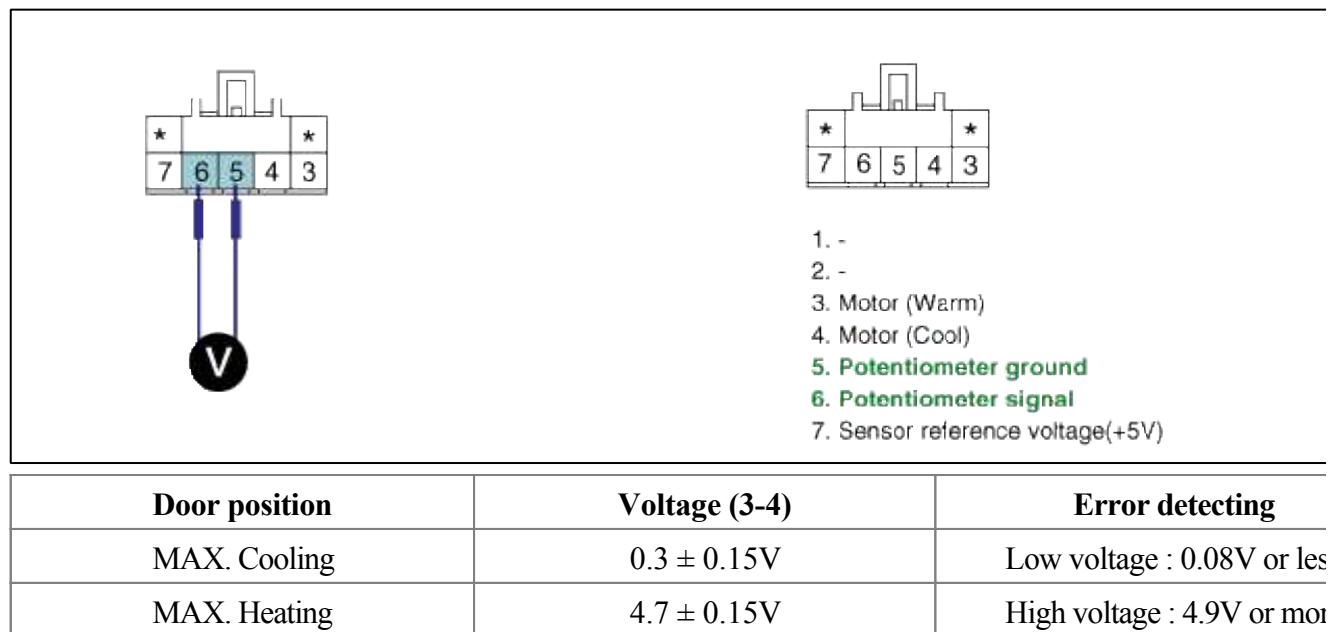
## 2. Check potentiometer

(1) Ignition "ON"

(2) Connect Passenger Air Mix potentiometer.

(3) Measure voltage between terminal "5" and "6" of Passenger Air Mix potentiometer while operating the temp. s

Specification : Refer the specifications in fig 3)



**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

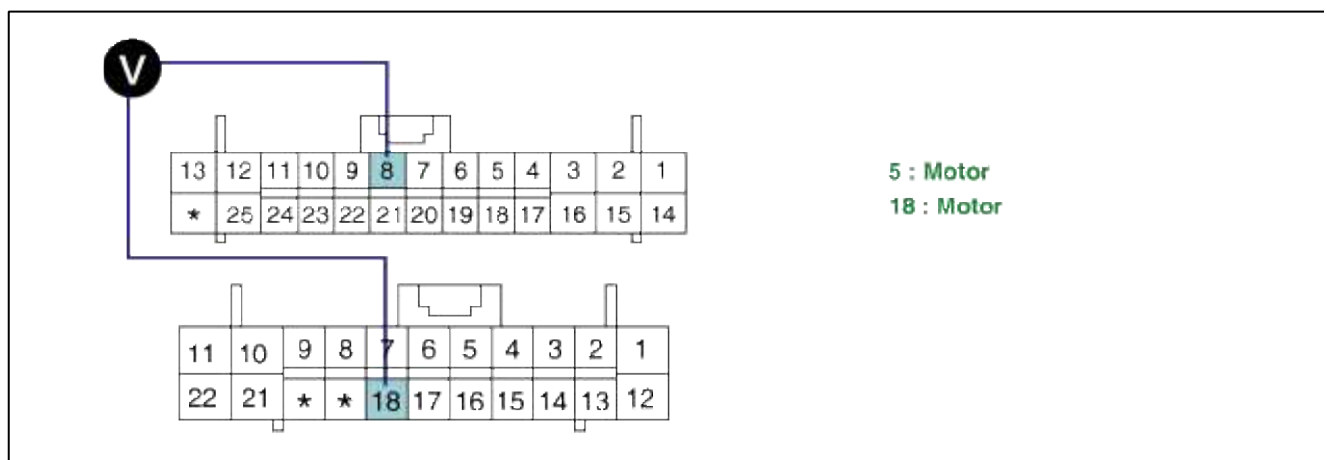
### 3. Check A/C Control Unit.

(1) Engine "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "8" and "18" of A/C Control Unit while operating the temp. switch.

Specification :Approx. 12V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

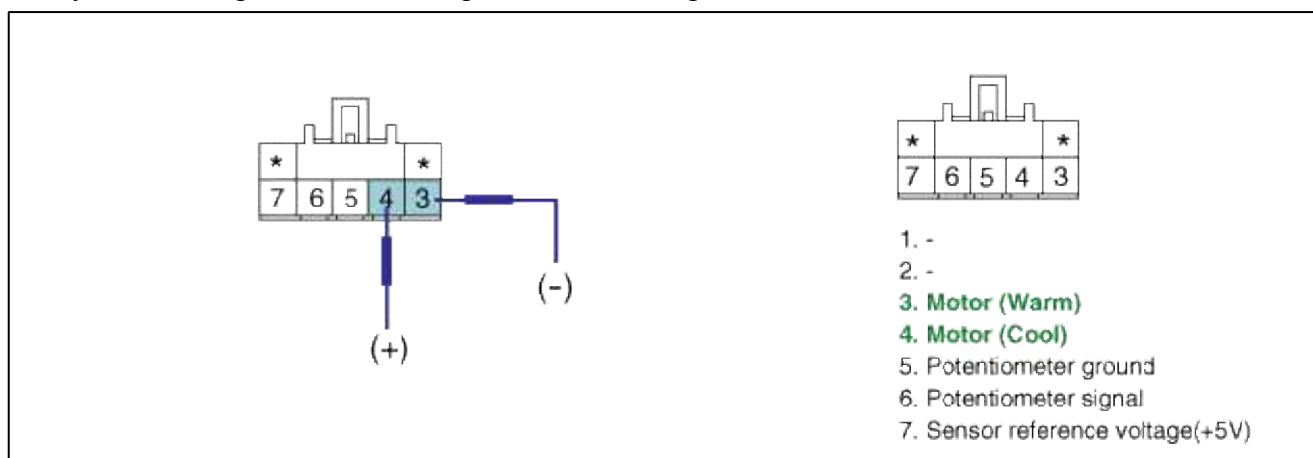
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

### COMPONENT INSPECTION



## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Passenger Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "3" and grounding terminal "4".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



## (5) Does the actuator work properly?

**YES**

Go to "Check potentiometer" procedure.

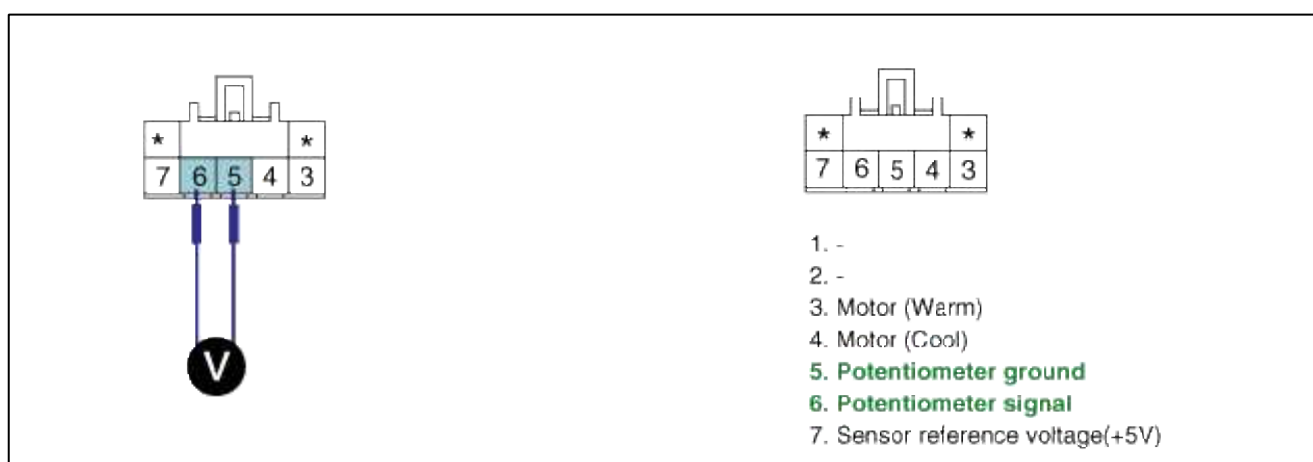
**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Passenger Air Mix potentiometer.
- (3) Measure voltage between terminal "5" and "6" of Passenger Air Mix potentiometer while operating the temp. s

Specification : Refer the specifications in fig 3)



Door position	Voltage (3-4)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or les
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or mor

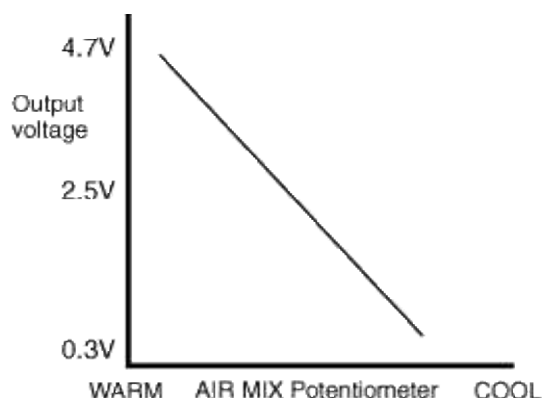
**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace it and then go to "Verification of Vehicle Repair" procedure.

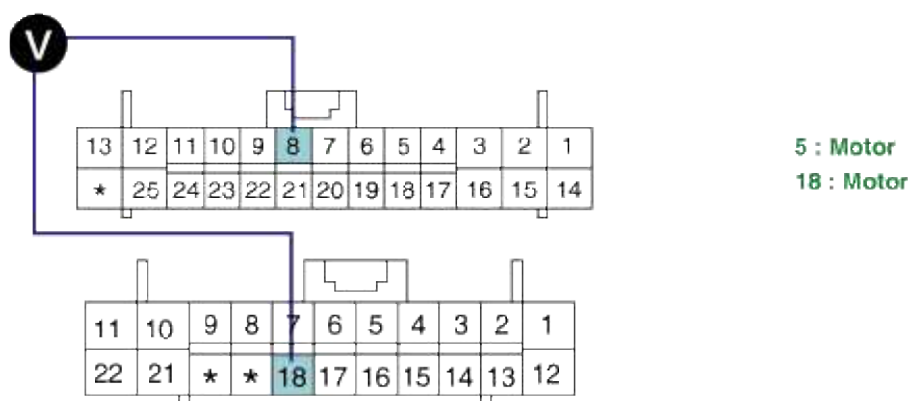
3. Check A/C Control Unit.

(1) Engine "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "8" and "18" of A/C Control Unit while operating the temp. switch.

Specification : Approx. 12V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

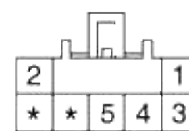
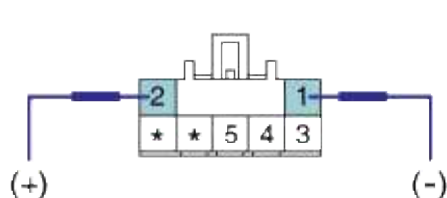
Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

## 1. Check actuator motor.

- (1) Ignition "OFF"
- (2) Disconnect Passenger Air Mix Potentiometer.
- (3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal "1" and grounding terminal "2".
- (4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



1. Motor (Warm)
2. Motor (Cool)
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

## (5) Does the actuator work properly?

YES

Go to "Check potentiometer" procedure.

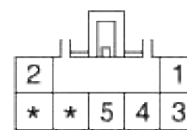
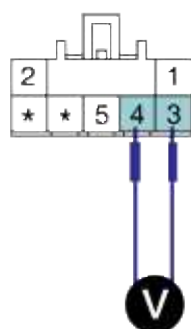
NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

## 2. Check potentiometer

- (1) Ignition "ON"
- (2) Connect Passenger Air Mix potentiometer.
- (3) Measure voltage between terminal "3" and "4" of Passenger Air Mix potentiometer while operating the temp. s

Specification : Refer the specifications in fig 3)



1. Motor (Warm)
2. Motor (Cool)
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

Door position	Voltage (3-4)	Error detecting
MAX. Cooling	$0.3 \pm 0.15V$	Low voltage : 0.08V or les
MAX. Heating	$4.7 \pm 0.15V$	High voltage : 4.9V or mor

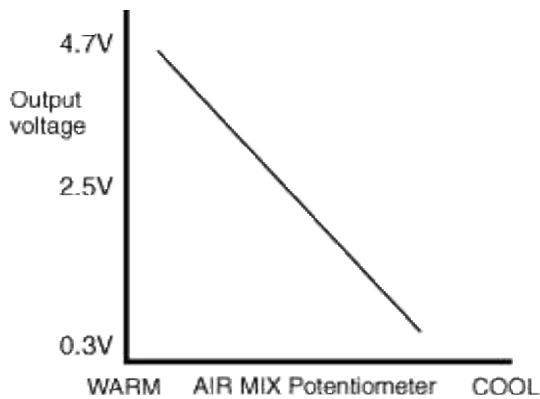
**Fig. 3**

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of setting temperature.

(4) Is the measured voltage within specifications in fig3?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace and then go to "Verification of Vehicle Repair" procedure.

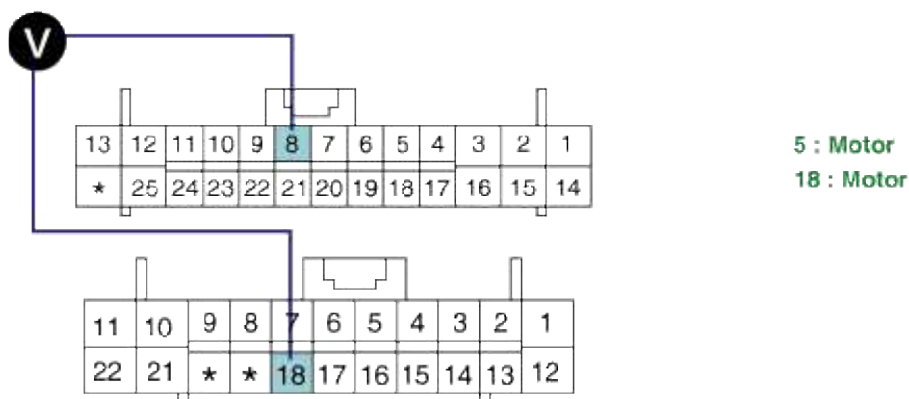
3. Check A/C Control Unit.

(1) Engine "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "8" and "18" of A/C Control Unit while operating the temp. switch.

Specification : Approx. 12V



(4) Is the measured voltage within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good A/C Control Unit and check for proper operation.

If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

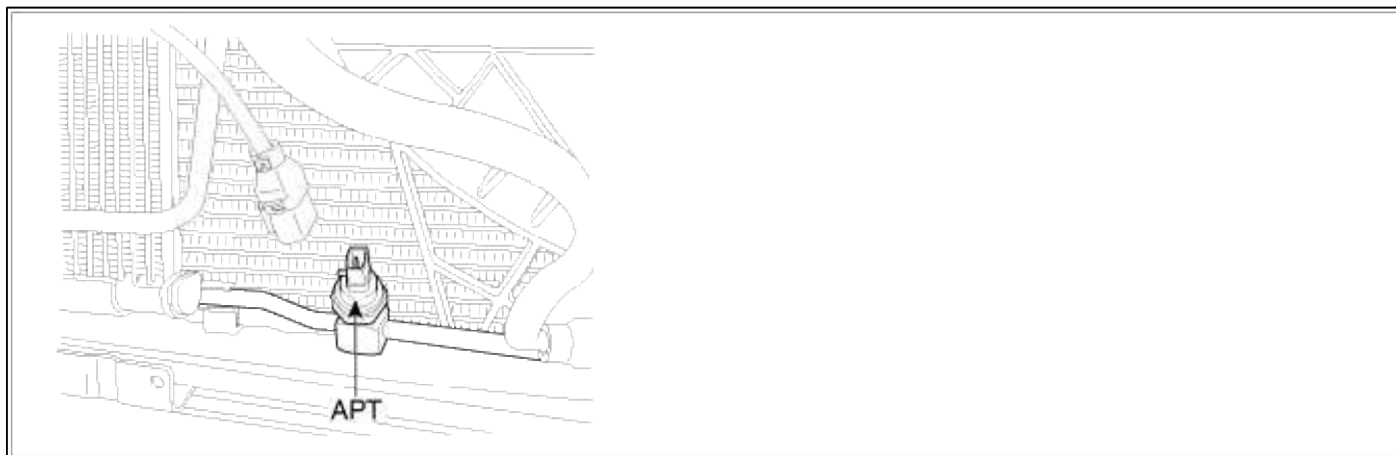
Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

## Heating,Ventilation, Air Conditioning > Troubleshooting > P0532

### COMPONENT LOCATION



### GENERAL DESCRIPTION

The ECM(Engine Control Module) receives pressure signal in the A/C refrigerant high pressure side from the A/C refrigerant pressure sensor. This input indicates how much load the A/C compressor is putting on the engine and is one of the factors used by the ECM in order to determine the idle air control position for the idle speed. The circuits

Checking output signals from A/C pressure sensor under detecting condition, if an signal below 0.25V lasts for more than 10 sec., ECM sets P0532.

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open in power circuit</li> <li>• Open or short to ground in signal circuit</li> <li>• Faulty A/C pressure sensor</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	• Engine running	
Thresh old value	• Sensor output voltage< 0.25V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test )	
MIL On Condition	• DTC only (NO MIL ON)	

### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<b>1.1 DIAGNOSTIC TROUBLE CODES</b>		
<b>PXXXX DTC TITLE</b>		
<b>NUMBER OF DTC : 1 ITEMS</b>		
<b>PART</b>	<b>ERAS</b>	<b>DTAL</b>

<b>PXXXX TITLE</b>	
<b>1.MIL STATUS:</b>	<b>ON/OFF</b>
<b>2.DTC STATUS:</b>	<b>PRESENT/HISTORY</b>
<b>3.DIAG.STATUS:</b>	<b>DIAGNOSIS FINISHED</b>
<b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b>	

(5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Power Circuit Inspection" procedure.

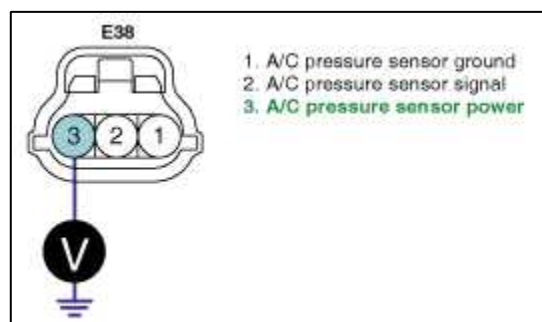
## POWER CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

---

Specification : approx. 5V

---



5. Is the measured voltage within specification ?

**YES**

Go to "Signal circuit inspection" procedure.

**NO**

Repair Open or Short to ground in A/C pressure sensor power circuit and go to "Verification of Vehicle Repair" procedure.

## SIGNAL CIRCUIT INSPECTION

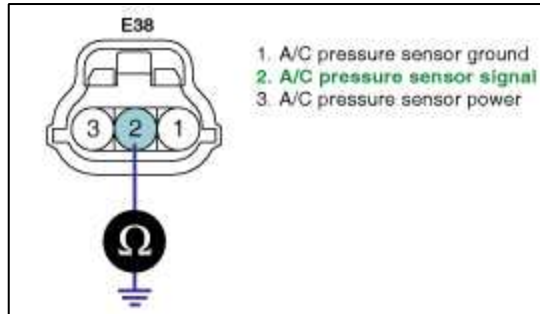
## 1. Check short to ground inspection

- (1) IG Key "OFF".
- (2) Disconnect A/C pressure sensor and ECM connector.
- (3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and chassis ground.

---

Specification : Infinite

---



## (4) Is the measured resistance within specification ?

**YES**

Go to "Check open in harness" procedure.

**NO**

Repair Short to ground in A/C pressure sensor signal circuit and go to "Verification of Vehicle Repair" procedure.

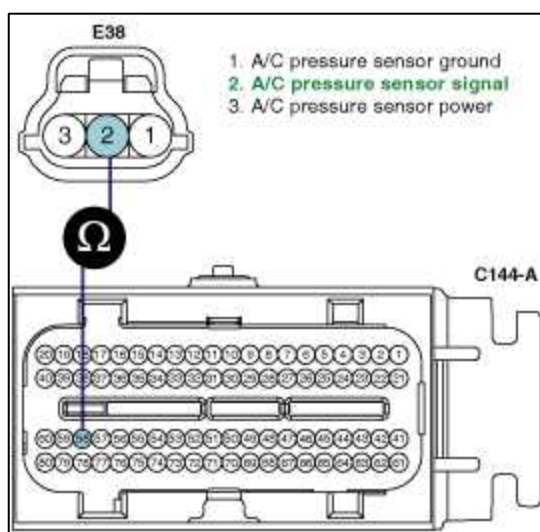
## 2. Check open in harness

- (1) IG Key "OFF".
- (2) Disconnect A/C pressure sensor and ECM connector.
- (3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and terminal 58 of ECM harness connector(C144-A).

---

Specification : Approx. below 1Ω

---



## (4) Is the measured resistance within specification ?

**YES**

Go to "Component inspection" procedure.

**NO**

Repair Open in A/C pressure signal circuit and go to "Verification of Vehicle Repair" procedure.



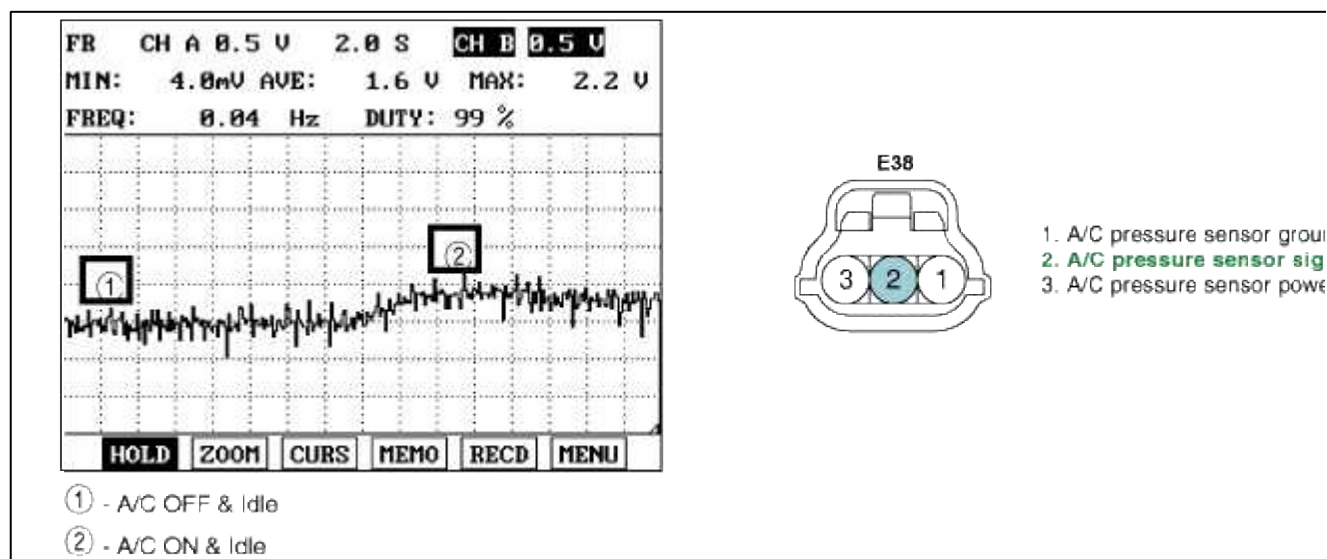
## COMPONENT INSPECTION

### 1. A/C pressure sensor inspection

- (1) IG Key "OFF" and connect the scantool.
- (2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.
- (3) Check the waveform with acceleration and deceleration after engine start.

#### Specification :

Pressure(psi)	14.7	128.5	242.3	356.1	469.
Voltage(V)	0.5	1.5	2.5	3.5	4.5



- (4) Is the measured waveform of A/C pressure sensor normal?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.

#### NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter

4. Is "History (Not Present)" fault displayed?

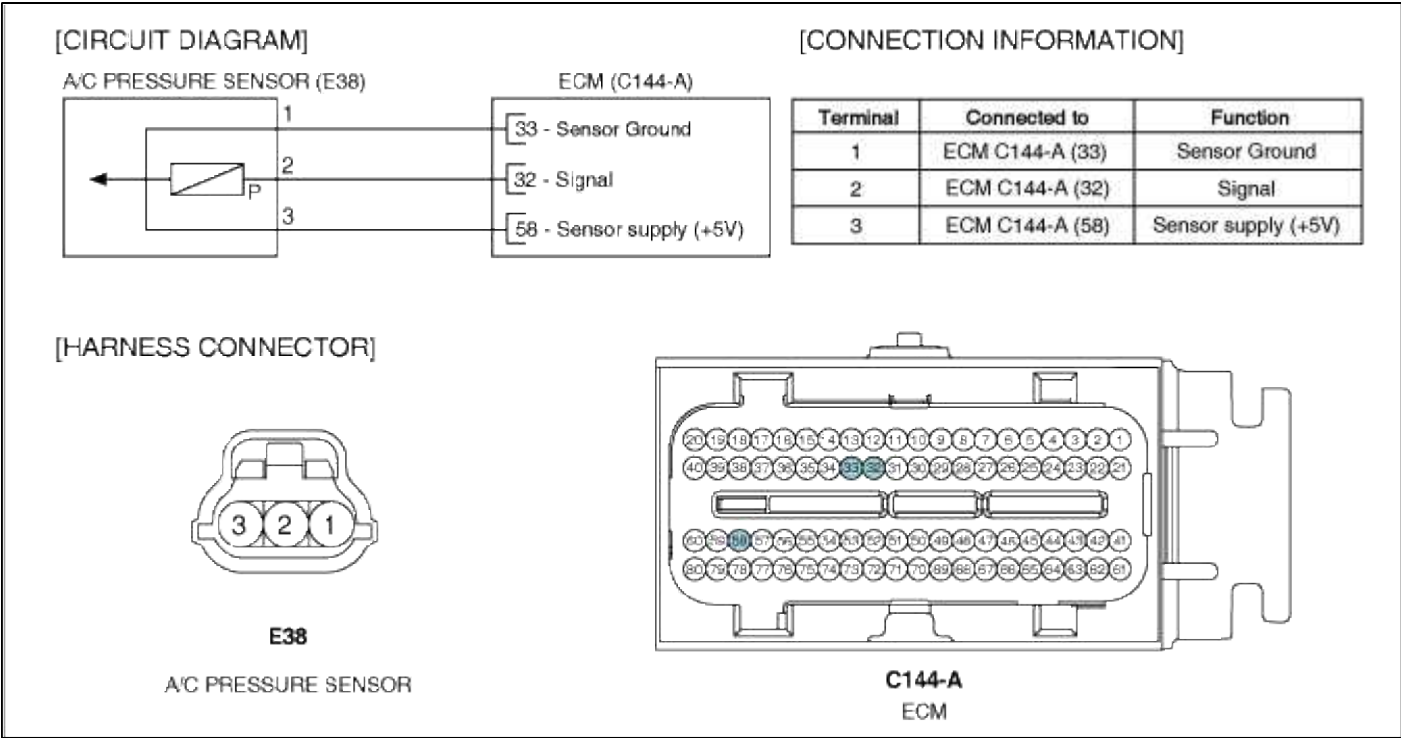
**YES**

System performing to specification at this time. Clear the DTC

**NO**

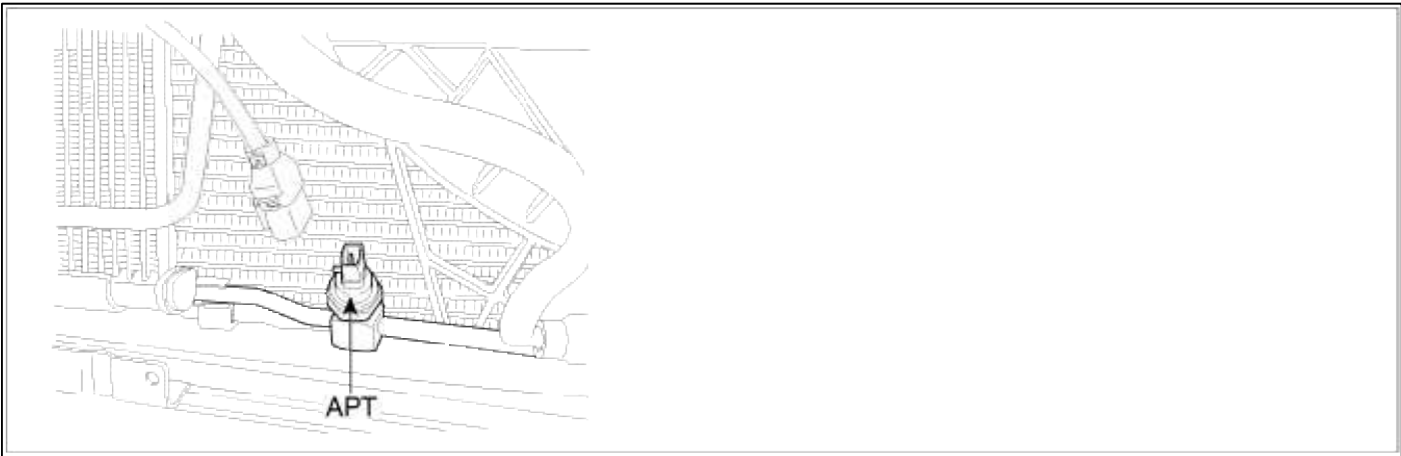
Go to the applicable troubleshooting procedure.

SCHEMATIC DIAGRAM



Heating,Ventilation, Air Conditioning > Troubleshooting > P0533

COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM(Engine Control Module) receives pressure signal in the A/C refrigerant high pressure side from the A/C refrigerant pressure sensor. This input indicates how much load the A/C compressor is putting on the engine and is one of the factors used by the ECM in order to determine the idle air control position for the idle speed. The circuits consist of a 5V reference and a ground, both provided by the ECM, and a signal from the sensor. The signal is a

voltage which is proportional to the A/C pressure from 0 to 5V. Low pressure produces a low voltage signal and high pressure a high-voltage signal.

### DTC DESCRIPTION

Checking output signals from A/C pressure sensor under detecting condition, if an signal above 4.65V lasts for more than 10 sec., ECM sets P0533.

### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to high voltage	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Short battery in signal circuit</li> <li>• Open in ground circuit</li> <li>• Faulty A/C pressure sensor</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	• Engine running	
Thresh old value	• Sensor output voltage > 4.65V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

### MONITOR DTC STATUS

#### 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<p><b>1.1 DIAGNOSTIC TROUBLE CODES</b></p> <p>PXXXX DTC TITLE</p>          <p>NUMBER OF DTC : 1 ITEMS</p> <p>PART ERAS DTAL</p>	<p><b>PXXXX TITLE</b></p>   <p>1.MIL STATUS: ON/OFF</p> <p>2.DTC STATUS: PRESENT/HISTORY</p> <p>3.DIAG.STATUS: DIAGNOSIS FINISHED</p>   <p>DTC CAUSE TO SYSTEM ERROR : PXXXX</p>
---	--

#### (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rej procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to " Power Circuit Inspection " procedure.

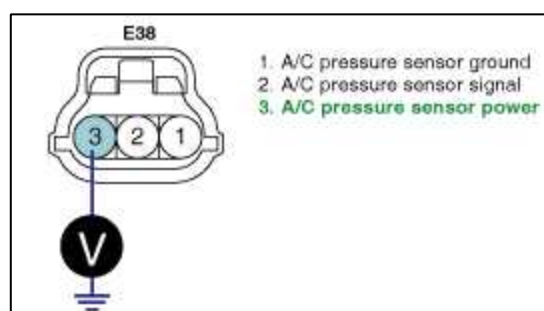
## POWER CIRCUIT INSPECTION

1. IG Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. IG Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

---

Specification : approx. 5V

---



5. Is the measured voltage within specification ?

**YES**

Go to "Ground circuit inspection" procedure.

**NO**

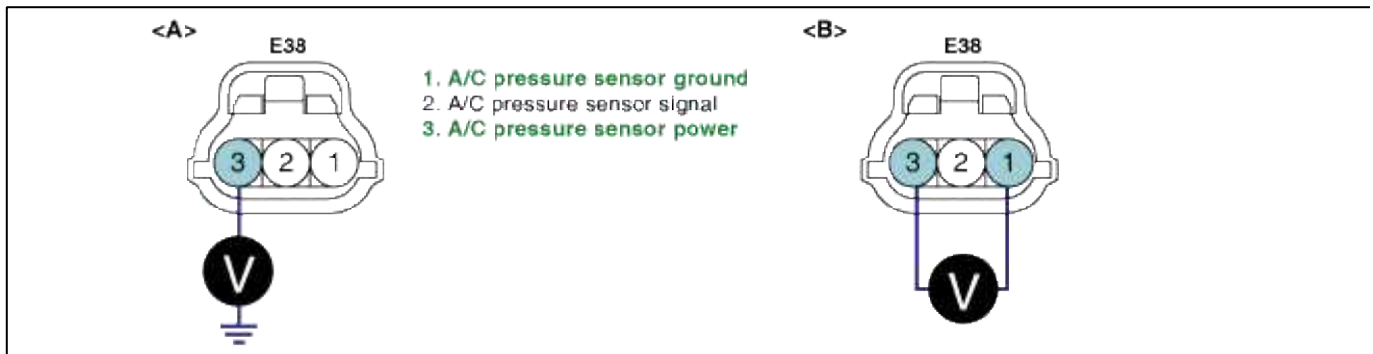
Repair Open in power circuit and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION

1. IG Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. IG Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground. (Fig A)

5. Measure the voltage between terminal 3 and terminal 1 of A/C pressure sensor harness connector. (Fig B)

Specification : The Difference between "A" and "B" is below 200mV.



6. Is the measured voltage within specification ?

**YES**

Go to "Signal circuit inspection" procedure.

**NO**

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### SIGNAL CIRCUIT INSPECTION

1. Voltage inspection

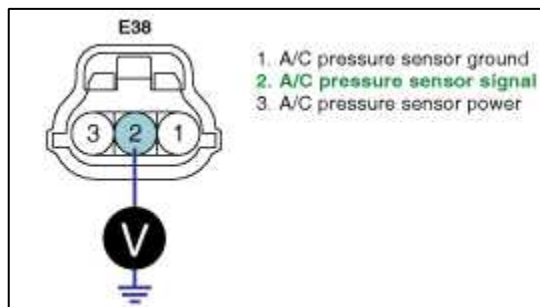
(1) IG Key "OFF".

(2) Disconnect the A/C pressure sensor connector.

(3) IG Key "ON".

(4) Measure the voltage between terminal 2 of A/C pressure sensor harness connector and chassis ground.

Specification : Approx. 0V



(5) Is the measured voltage within specification ?

**YES**

Go to "Component inspection" procedure.

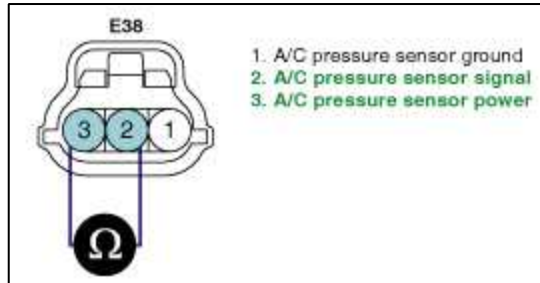
**NO**

Go to "Check short to battery in harness" procedure.

## 2. Check short to battery in harness

- (1) IG Key "OFF".
- (2) Disconnect A/C pressure sensor connector and ECM connector.
- (3) Measure the resistance between terminal 2 and terminal 3 of A/C pressure sensor harness connector.

Specification : Infinite



## (4) Is the measured resistance within specification ?

**YES**

Go to "Component inspection" procedure.

**NO**

Repair Short in signal circuit and go to "Verification of Vehicle Repair" procedure.

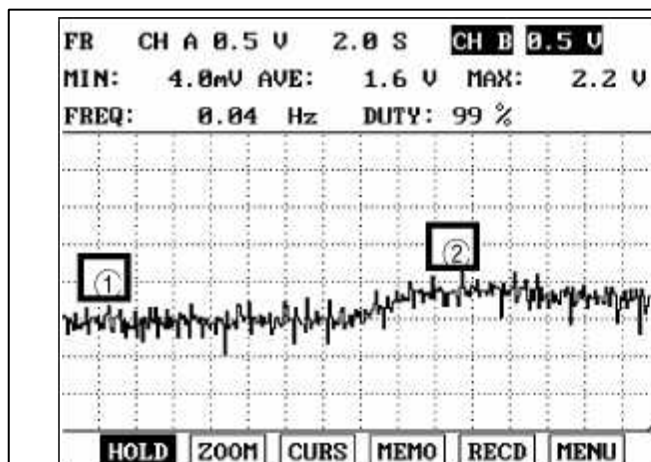
## COMPONENT INSPECTION

## 1. A/C pressure sensor inspection

- (1) IG Key "OFF" and connect the scantool.
- (2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.
- (3) Check the waveform with acceleration and deceleration after engine start.

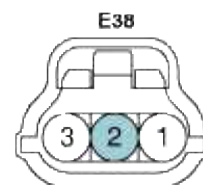
**Specification :**

Pressure(psi)	14.7	128.5	242.3	356.1	469.
Voltage(V)	0.5	1.5	2.5	3.5	4.5



① - A/C OFF & Idle

② - A/C ON & Idle



1. A/C pressure sensor ground
2. A/C pressure sensor signal
3. A/C pressure sensor power

(4) Is the measured waveform of A/C pressure sensor normal?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.

#### NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

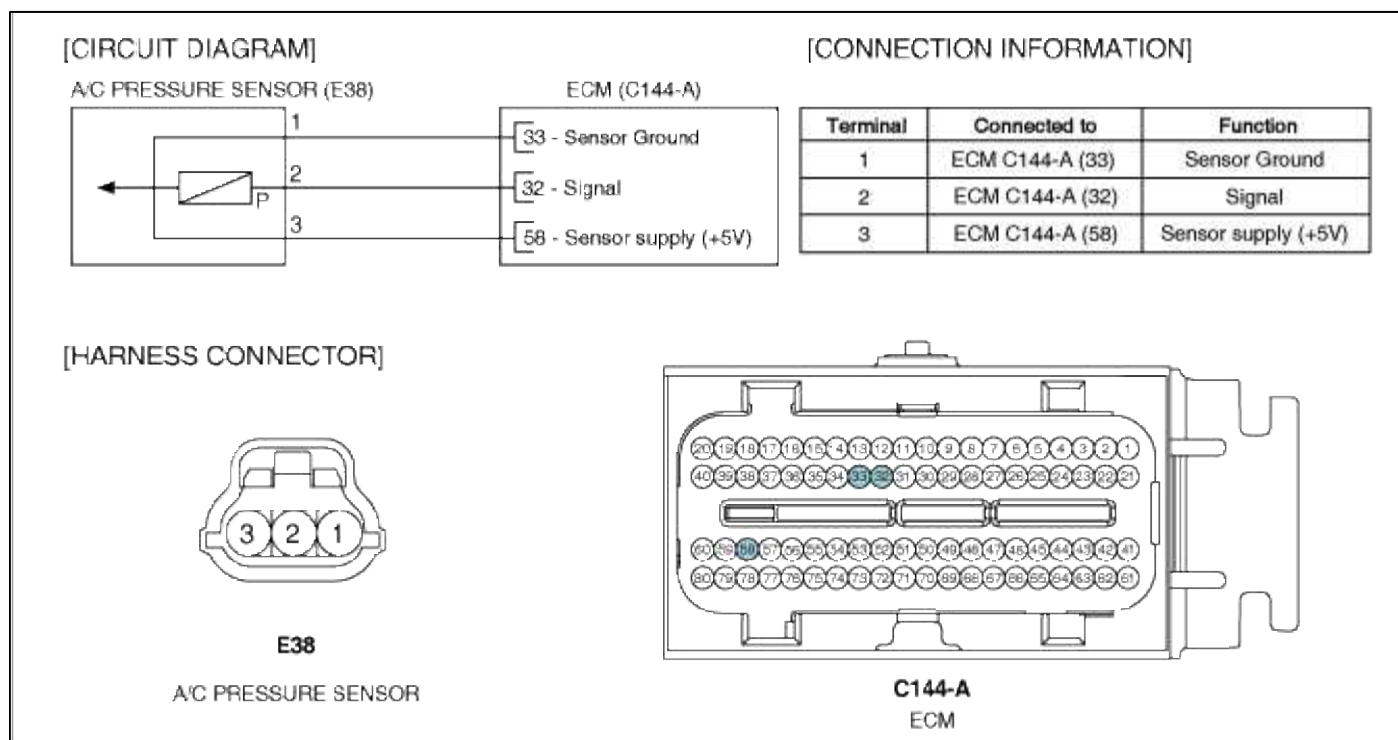
**YES**

System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

### SCHEMATIC DIAGRAM



The A/C clutch relay is activated if the A/C switch is operated while the blower is running and system operation is enabled by the ECM. When A/C is requested, the Engine Control Module(ECM) provides a ground path to the A/C clutch relay control circuit. When the relay circuit is grounded, the A/C clutch relay is energized. The ECM delays grounding the relay circuit for a short time, so the ECM can adjust the engine idle speed for the additional load. The ECM will temporarily de-energized the A/C clutch relay for one or more of the following conditions:

- Full acceleration when the throttle is at WOT.(Wide Open Throttle)
- Risk of overheating: Engine coolant temp. exceeds threshold value
- A/C system pressure exceeds threshold value
- Engine starting

#### DTC DESCRIPTION

ECM monitors voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage lower than the specified value is detected for more than 5 sec., ECM sets P0646.

#### DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Detects circuit short to low voltage</li> </ul>	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Open or short to ground in A/C relay circuit</li> <li>• Faulty A/C relay</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>• After 0.5 sec under conditions below</li> <li>• No DTC exists</li> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Open or short to ground</li> </ul>	
Diagnosis Time	<ul style="list-style-type: none"> <li>• Continuous (More than 5 seconds failure for every 10 seconds test)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• DTC only (NO MIL ON)</li> </ul>	

#### MONITOR DTC STATUS

##### 1. Check DTC Status

(1) Connect scantool to Data Link Connector(DLC).

(2) IG "ON".

(3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu



(4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

(5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

#### TERMINAL AND CONNECTOR INSPECTION

- Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to "Power Circuit Inspection" procedure.

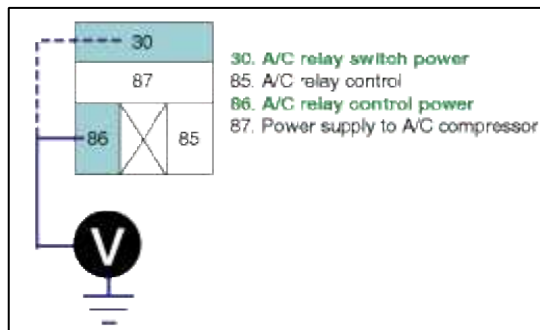
#### POWER CIRCUIT INSPECTION

1. Check voltage
  - (1) IG "OFF".
  - (2) Disconnect A/C relay.
  - (3) IG "ON" and ENG "OFF"
  - (4) Measure the voltage between terminal 30 of A/C relay harness connector and chassis ground.
  - (5) Measure the voltage between terminal 86 of A/C relay harness connector and chassis ground.

---

Specification : B+

---



- (6) Is the measured voltage normal?

**YES**

Go to "Control circuit inspection" procedure.

**NO**

Check the fuse between Battery and A/C relay.

Check Chassis ground for looseness.

Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

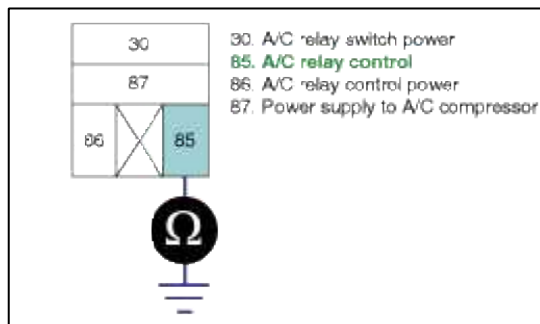
## CONTROL CIRCUIT INSPECTION

1. Check short in harness
  - (1) IG "OFF".
  - (2) Disconnect A/C relay and ECM connector.
  - (3) Measure the resistance between terminal 85 of A/C relay harness connector and chassis ground.

---

Specification : Infinite

---



- (4) Is the measured resistance within specification ?

**YES**

Go to "Check open in harness" as follows.

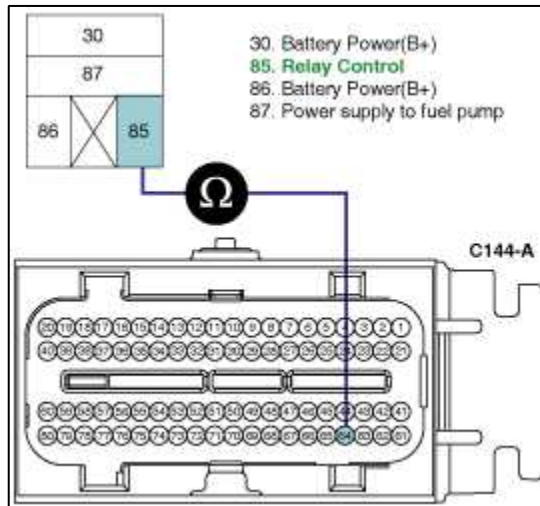
**NO**

Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

## 2. Check open in harness

- (1) IG "OFF".
- (2) Disconnect A/C relay and ECM connector.
- (3) Measure the resistance between terminal 85 of A/C relay harness connector and terminal 64 of ECM harness connector(C144-A).

Specification : Approx. below 1Ω



## (4) Is the measured resistance within specification ?

**YES**

Go to "Component inspection" procedure.

**NO**

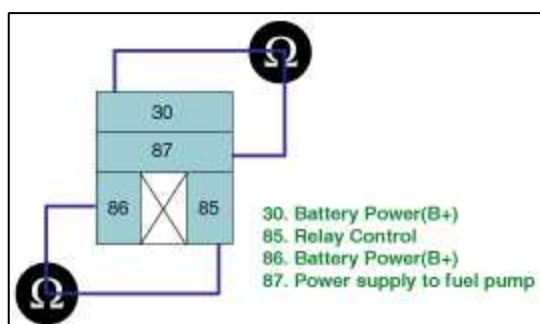
Repair Open in Coil control harness and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION

## 1. Check A/C relay

- (1) IG "OFF".
- (2) Disconnect A/C relay.
- (3) Measure the resistance between terminal 30 and 87 of A/C relay.
- (4) Measure the resistance between terminal 85 and 86 of A/C relay.

Terminal	Power approval
30~87	NO
85~86	YES (About 70 ~ 120Ω)



(5) Is the measured resistance within specification ?

**YES**

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known - good A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.

#### NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

### VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

**YES**

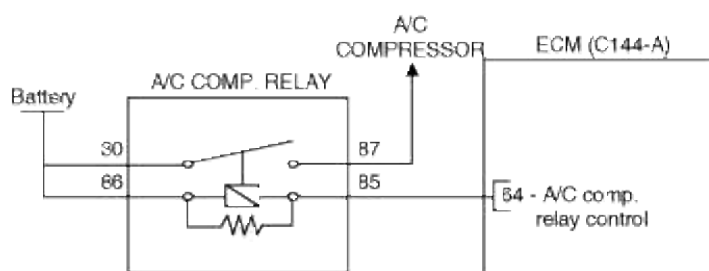
System performing to specification at this time. Clear the DTC

**NO**

Go to the applicable troubleshooting procedure.

### SCHEMATIC DIAGRAM

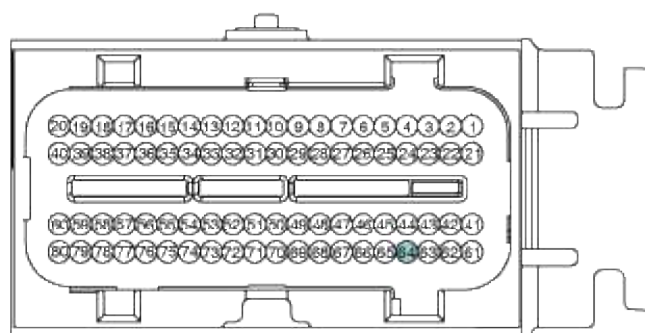
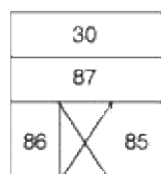
#### [CIRCUIT DIAGRAM]



#### [CONNECTION INFORMATION]

Terminal	Connected to	Function
87	A/C COMPRESSOR	Power to A/C compressor
86	Battery	Power Supply (B+)
85	ECM C144-A (64)	A/C comp. relay control
30	Battery	Power Supply (B+)

#### [HARNESS CONNECTOR]



**C144-A**  
ECM

**Heating,Ventilation, Air Conditioning > Troubleshooting > P0647****GENERAL DESCRIPTION**

The A/C clutch relay is activated if the A/C switch is operated while the blower is running and system operation is enabled by the ECM. When A/C is requested, the Engine Control Module(ECM) provides a ground path to the A/C clutch relay control circuit. When the relay circuit is grounded, the A/C clutch relay is energized. The ECM delays grounding the relay circuit for a short time, so the ECM can adjust the engine idle speed for the additional load. The ECM will temporarily de-energized the A/C clutch relay for one or more of the following conditions:

- Full acceleration when the throttle is at WOT.(Wide Open Throttle)
- Risk of overheating: Engine coolant temp. exceeds threshold value
- A/C system pressure exceeds threshold value
- Engine starting

**DTC DESCRIPTION**

ECM monitors voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage higher than the specified value is detected for more than 5 sec., ECM sets P0647.

**DTC DETECTING CONDITION**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>• Detects circuit short to high voltage</li> </ul>	<ul style="list-style-type: none"> <li>• Poor connection</li> <li>• Short to power in A/C relay circuit</li> <li>• Faulty A/C relay</li> <li>• Faulty ECM</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>• After 0.5 sec under conditions below</li> <li>• No DTC exists</li> <li>• Engine running</li> <li>• <math>11V \leq \text{Battery voltage} \leq 16V</math></li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Short to power</li> </ul>	
Diagnosis Time	<ul style="list-style-type: none"> <li>• Continuous (More than 5 seconds failure for every 10 seconds test)</li> </ul>	
MIL On Condition	<ul style="list-style-type: none"> <li>• DTC only (NO MIL ON)</li> </ul>	

**MONITOR DTC STATUS**

## 1. Check DTC Status

- (1) Connect scantool to Data Link Connector(DLC).
- (2) IG "ON".
- (3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F5(INFO) to check DTC's information from DTCs menu
- (4) Read "DTC Status" parameter.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.1 DIAGNOSTIC TROUBLE CODES</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX DTC TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">            </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>NUMBER OF DTC : 1 ITEMS</b> </div> <div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-between;"> <span><b>PART</b></span> <span><b>ERAS</b></span> <span><b>DTAL</b></span> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>PXXXX TITLE</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>1.MIL STATUS: ON/OFF</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>2.DTC STATUS: PRESENT/HISTORY</b> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>3.DIAG.STATUS: DIAGNOSIS FINISHED</b> </div> <div style="border: 1px solid black; padding: 5px;"> <b>DTC CAUSE TO SYSTEM ERROR : PXXXX</b> </div>
--	---

- (5) Is "Present" Fault displayed?

**YES**

Go to "Terminal and connector inspection" procedure.

**NO**

Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and E memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Rep procedure.

## TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES**

Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO**

Go to " Power Circuit Inspection " procedure.

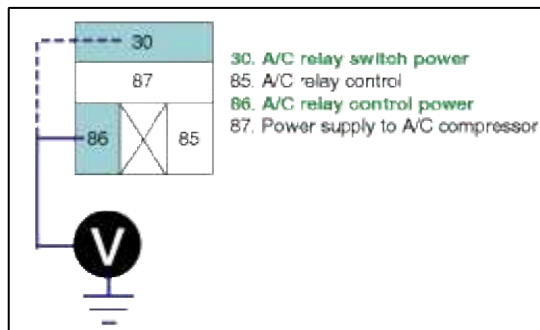
## POWER CIRCUIT INSPECTION

1. Check voltage
  - (1) IG "OFF".
  - (2) Disconnect A/C relay.
  - (3) IG "ON" and ENG "OFF".
  - (4) Measure the voltage between terminal 30 of A/C relay harness connector and chassis ground.
  - (5) Measure the voltage between terminal 86 of A/C relay harness connector and chassis ground.

---

Specification : B+

---



- (6) Is the measured voltage normal?

**YES**

Go to "Control circuit inspection" procedure.

**NO**

Check the fuse between Battery and A/C relay.

Check Chassis ground for looseness.

Repair open or short to ground in power harness and go to "Verification of Vehicle Repair" procedure.

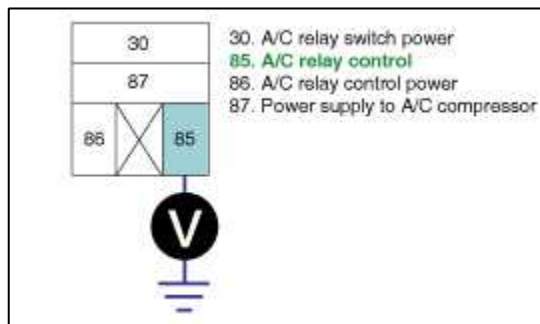
## CONTROL CIRCUIT INSPECTION

1. Check short in harness
  - (1) IG "ON".
  - (2) Disconnect A/C relay.
  - (3) Measure the voltage between terminal 85 of A/C relay harness connector and chassis ground.

---

Specification : Approx. 0V

---



- (4) Is the measured voltage within specification ?

**YES**

Go to "Component inspection" procedure.

**NO**

Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

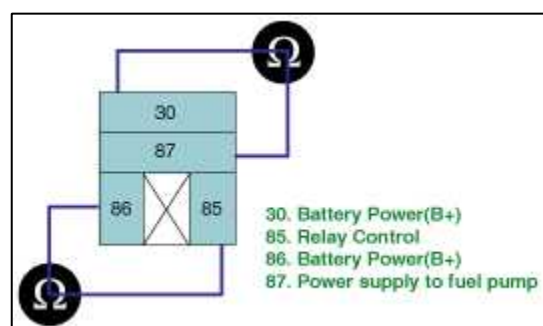
## COMPONENT INSPECTION

## 1. Check A/C relay

- (1) IG "OFF".
- (2) Disconnect A/C relay.
- (3) Measure the resistance between terminal 30 and 87 of A/C relay.
- (4) Measure the resistance between terminal 85 and 86 of A/C relay.

## SPECIFICATION

Terminal	Power approval
30~87	NO
85~86	YES (About 70 ~ 120Ω)



## (5) Is the measured resistance within specification ?

YES

Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known - good A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.

## NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by ECM. After testing ECM on the vehicle, use this function before reusing the ECM

## VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is "History (Not Present)" fault displayed?

YES

System performing to specification at this time. Clear the DTC

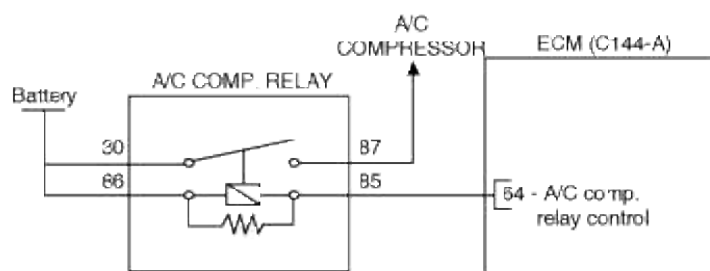
NO

Go to the applicable troubleshooting procedure.

## SCHEMATIC DIAGRAM



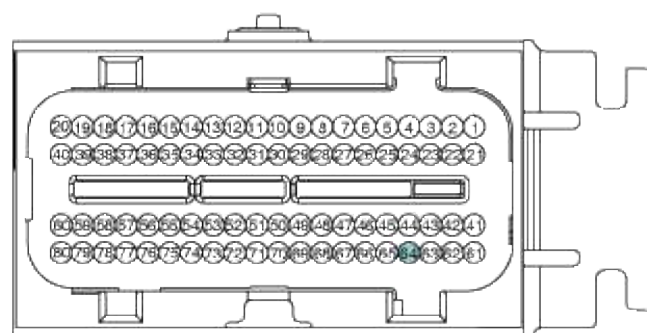
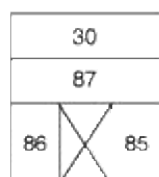
## [CIRCUIT DIAGRAM]



## [CONNECTION INFORMATION]

Terminal	Connected to	Function
87	A/C COMPRESSOR	Power to A/C compressor
86	Battery	Power Supply (B+)
85	ECM C144-A (64)	A/C comp. relay control
30	Battery	Power Supply (B+)

## [HARNESS CONNECTOR]



**C144-A**  
ECM

## SORENTO(BL) > 2007 > G 3.3 DOHC > Restraint

### Restraint > General Information > General Safety Information and Caution

#### PRECAUTIONS

##### GENERAL PRECAUTIONS

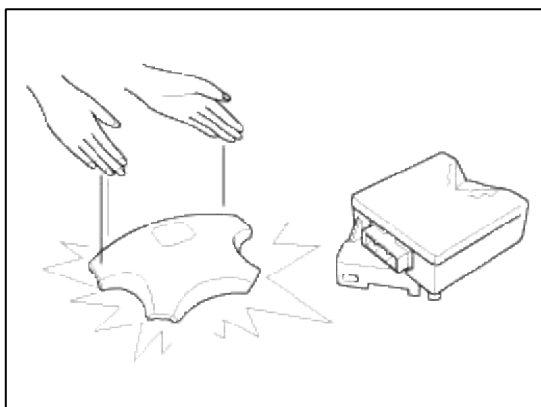
Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

#### NOTE

The contents in the memory are not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality. Do not install used SRS parts from another vehicle. Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it. Do not install any part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.



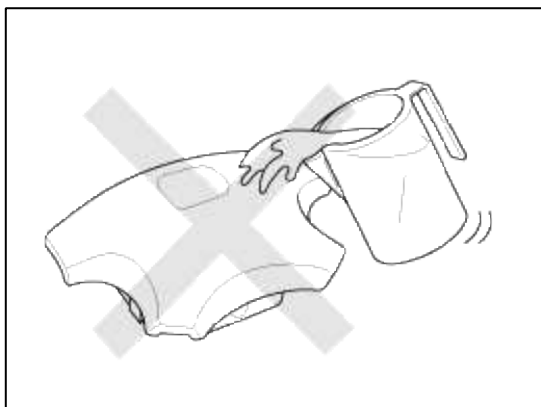
- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

#### AIRBAG HANDLING AND STORAGE

Do not disassemble the airbags; it has no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.

For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.



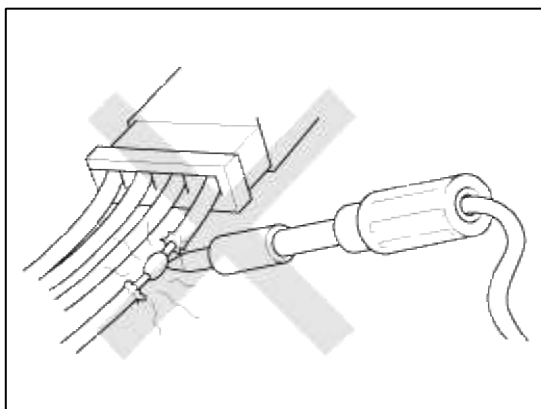
- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85°C/185°F).
  - Never perform electrical inspections to the airbags, such as measuring resistance.
  - Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
  - Refer to the scrapping procedures for disposal of the damaged airbag.
  - Be careful not to bump or impact the SRS unit or the side impact sensors or front impact sensor whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
  - During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRS unit and the side impact sensors and the front impact sensor. The airbags could accidentally deploy and cause damage or injury.
  - Replace the front airbag module, SRSCM, front impact sensor when deploying the front airbag. Replace the airbag wiring when the airbag wiring gets damaged.
  - Replace the curtain airbag module, SRSCM, side impact sensors when deploying the curtain airbag.
  - Replace the airbag when the airbag wiring gets damaged.
- After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRS unit and the side impact sensors. If there is any damage, replace the SRS unit, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRS unit, the front impact sensor or the side impact sensors.
  - Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRS unit.
  - Be sure the SRS unit, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
  - Do not spill water or oil on the SRS unit, or the front impact sensor or the side impact sensors and keep them away from dust.
  - Store the SRS unit, the front impact sensor and the side impact sensors in a cool (15 ~ 25°C/ 59 ~ 77°F) and dry (30 ~ 80% relative humidity, no moisture) area.

#### WIRING PRECAUTIONS

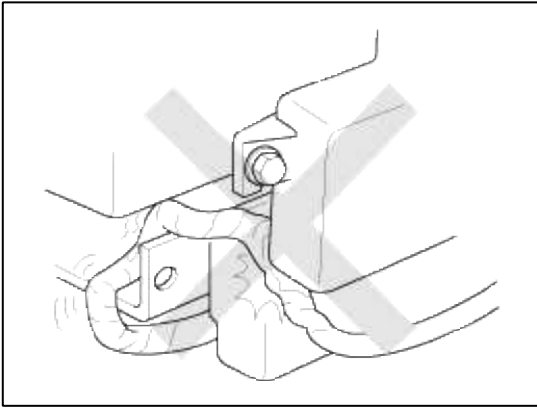
SRS wiring can be identified by special yellow outer covering (except the SRS circuits under the front seats and the SRS circuits in the FEM of engine room).

Observe the instructions described in this section.

- Never attempt to modify, splice, or repair SRS wiring.
- If there is an open or damage in SRS wiring, replace the harness.



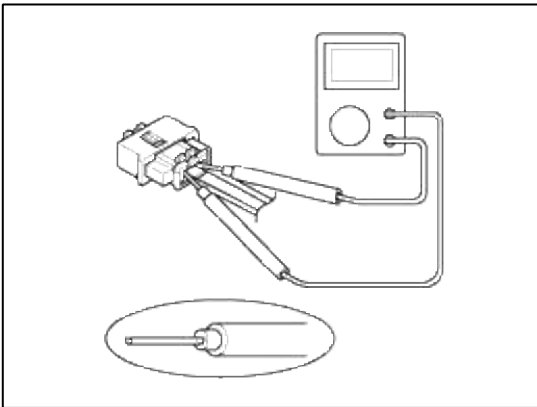
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- Make sure all SRS ground locations are clean, and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

#### PRECAUTIONS FOR ELECTRICAL INSPECTIONS

- When using electrical test equipment, insert the probe of the tester into the wire side of the connector. Do not insert the probe of the tester into the terminal side of the connector, and do not tamper with the connector.



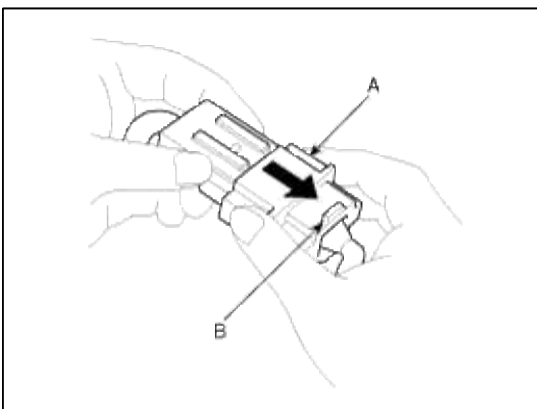
- Use a u-shaped probe. Do not insert the probe forcibly.
  - Use specified service connectors for troubleshooting.
- Using improper tools could cause an error in inspection due to poor metal contact.

#### SPRING-LOADED LOCK CONNECTOR

##### AIRBAG CONNECTOR(I)

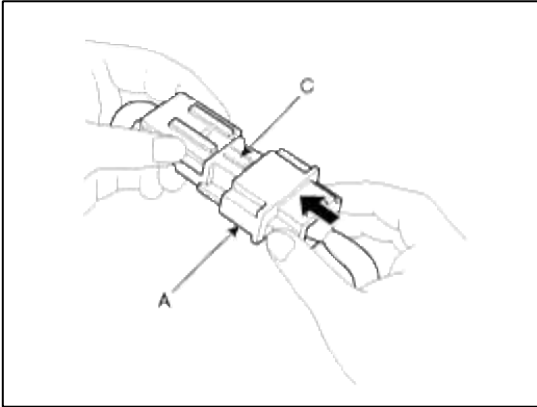
##### DISCONNECTING

To release the lock, pull the spring-loaded sleeve (A) toward the stop (B) while holding the opposite half of the connector. Then pull the connector halves apart. Be sure to pull on the sleeve and not on the connector half.

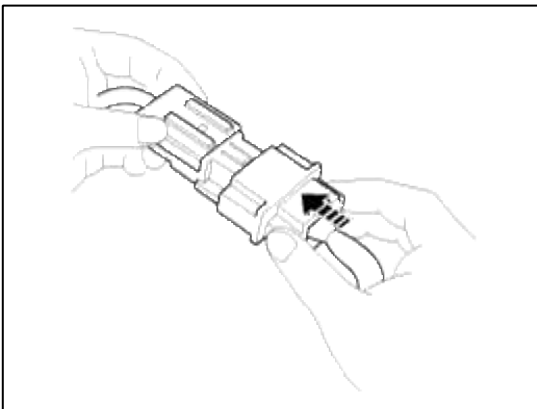


##### CONNECTING

1. To reconnect, hold the pawl-side connector half, and press on the back of the sleeve-side connector half in the direction shown. As the two connector halves are pressed together, the sleeve (A) is pushed back by the pawl (C). Do not touch the sleeve.

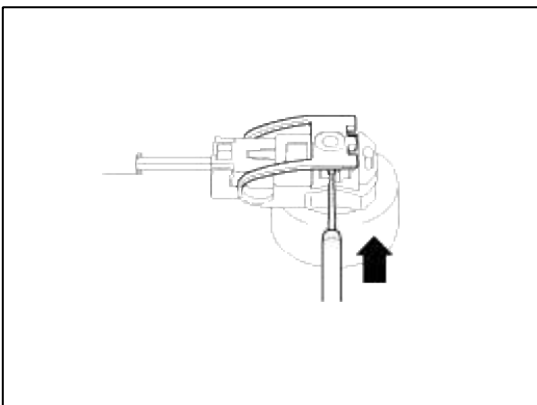
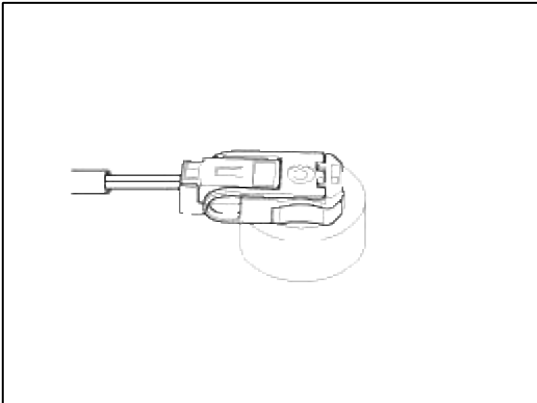


2. When the connector halves are completely connected, the pawl is released, and the spring-loaded sleeve locks the connector.

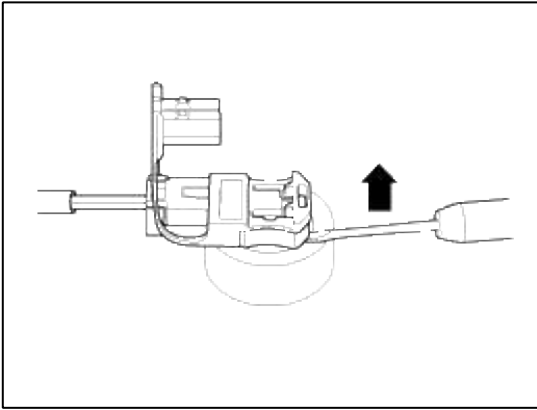


## AIRBAG CONNECTOR(II) DISCONNECTING

1. To remove the locking button, gently use a small screwdriver to pry locking buttons upwards.

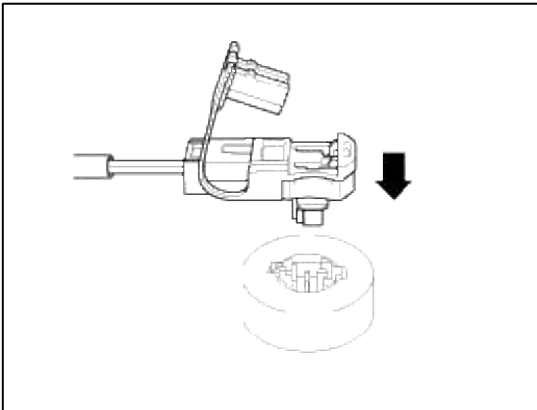


2. Gently lift up the connector by inserting the screwdriver below the connector body.

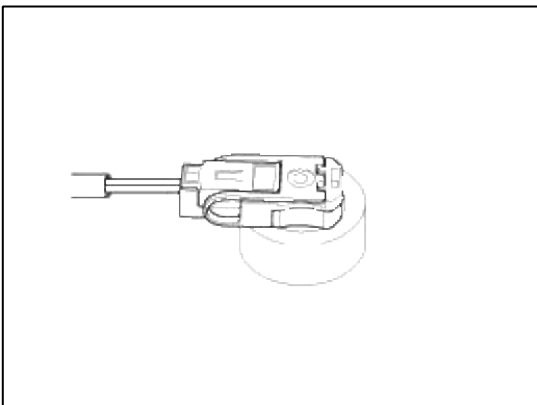
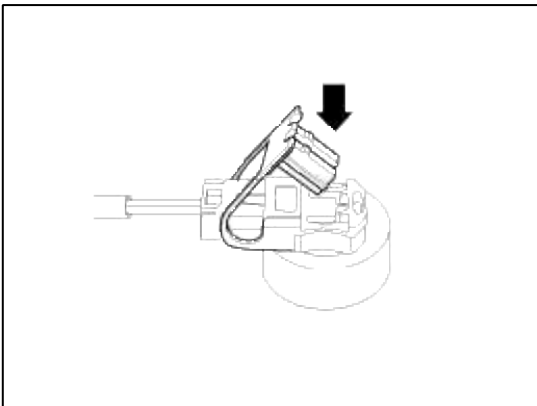


## CONNECTING

1. Connect the connector body before inserting the locking button of connector.



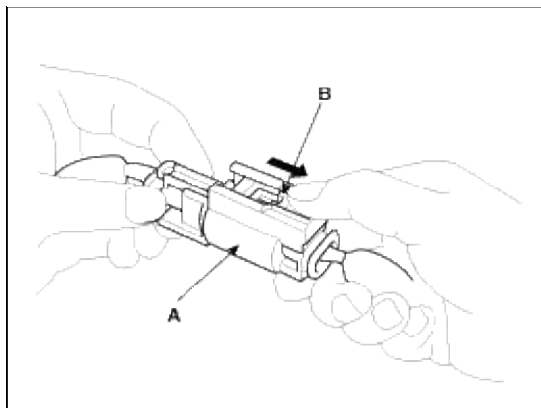
2. Press the locking button of connector firmly until the connector "clicks" into the locking position.



## AIRBAG CONNECTOR(III)

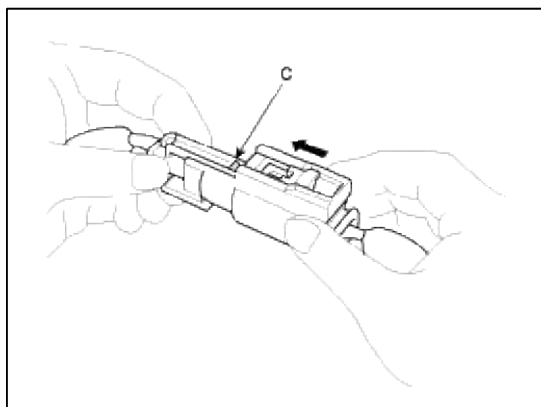
### DISCONNECTING

To release the lock, pull the spring-loaded sleeve (A) and the slider (B), while holding the opposite half of the connector. Pull the connector halves apart. Be sure to pull on the sleeve and not on the connector half.



## CONNECTING

Hold both connector halves and press firmly until the projection (C) of the sleeve-side connector clicks to lock.



## Restraint > General Information > General Information

### GENERAL

The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger, curtain airbag and belt pretensioner in certain frontal or side collisions.

The SRS (Airbag) consists of : a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit ; curtain airbag modules located inside of the headliner which contains folded cushions and inflator units. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measure the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

### SRSCM (SRS CONTROL MODULE)

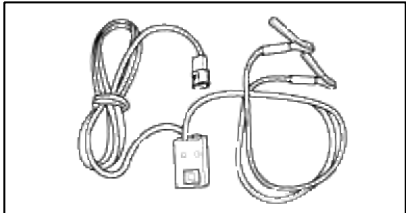
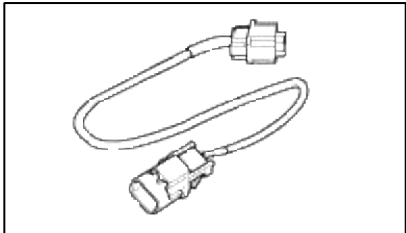
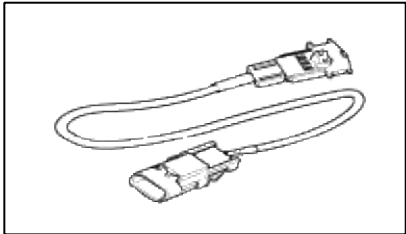
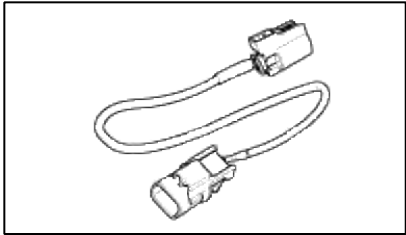
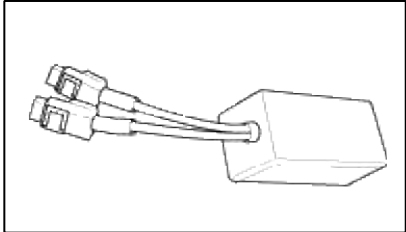
SRSCM will detect front impact with front impact sensor, and side impact with side impact sensor, and determine airbag module deployment.

1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provide ignition voltage for 2 front airbag ignition circuits and the internal operation voltage of the SRSCM. If the internal operation voltage is below critical value setting, it will perform resetting.
2. Safety sensor: Safety sensor is located in airbag ignition circuit. Safety sensor will operate airbag circuit at any deployment condition and release airbag circuit safely at normal driving condition. Safety sensor is a double contact electro-mechanical switch that will close detecting deceleration above certain criteria.
3. Back up power supply: SRSCM has separate back up power supply, that will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
4. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure while vehicle power supply is on, system failure may be checked with trouble codes using scan tool. (Hi-Scan)

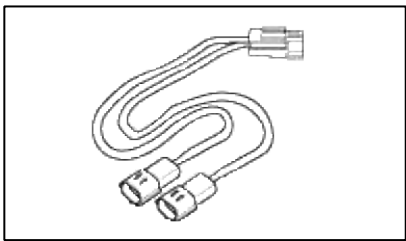
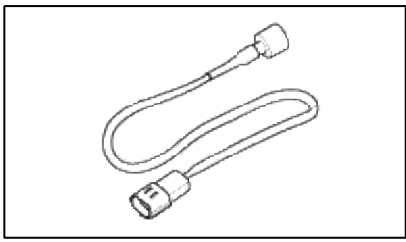
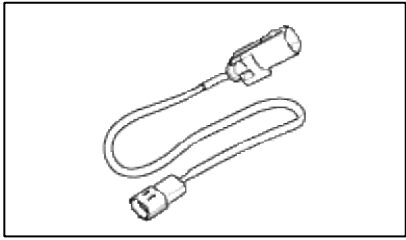
5. Airbag warning lamp on: Upon detecting error, the module will transmit signal to SRSCM indicator lamp located at cluster. MIL lamp will indicate driver SRS error. Upon ignition key on, SRS lamp will turn on for about six seconds.
6. Trouble code registration: Upon error occurrence in system, SRSCM will store DTC corresponding to the error. DTC can be cleared only by Hi-Scan. However, if an internal fault code is logged or if a crash is recorded the fault clearing should not happen.
7. Self diagnostic connector: Data stored in SRSCM memory will be output to Hi-Scan or other external output devices through connector located below driver side crash pad.
8. Once airbag is deployed, SRSCM should not be used again but replaced.
9. SRSCM will determine whether passenger put on seat belt by the signal from built-in switch in seat belt buckle, and deploy front seat airbag at each set crash speed.
10. Side airbag deployment will be determined by SRSCM that will detect satellite sensor impact signal upon side crash, irrespective to seat belt condition.

### Restraint > General Information > Special Service Tools

#### SPECIAL SERVICE TOOLS

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-3E110		Use with deployment tool. (PAB)
Deployment adapter 0957A-38500		Use with deployment tool. (DAB, CAB, BPT)
Deployment adapter 0957A-3F100		Use with deployment tool. (KAB)
Dummy 0957A-38200		Simulator to check the resistance of each wiring harness



Dummy adapter 0957A-3E100		Use with dummy (PAB)
Dummy adapter 0957A-2G000		Use with dummy (DAB, CAB, BPT)
Dummy adapter 0957A-3F000		Use with dummy (KAB)

DAB : Driver Airbag

PAB : Passenger Airbag

KAB : Knee Airbag

CAB : Curtain Airbag

BPT : Seat Belt Retractor Pretensioner

## Restraint > General Information > Description and Operation

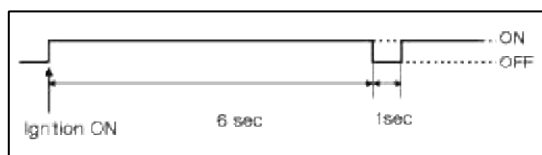
### WARNING LAMP ACTIVATION

#### WARNING LAMP BEHAVIOR AFTER IGNITION ON

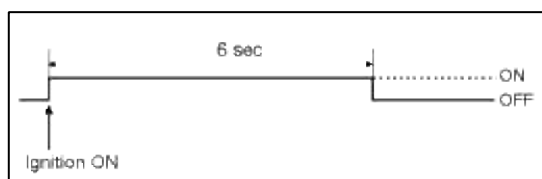
As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.

The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward. However, in order to indicate the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.

1. Active fault or historical fault counter is greater or equal to 10



2. Normal or historical fault counter is less than 10



#### SRSCM INDEPENDENT WARNING LAMP ACTIVATION

There are certain fault conditions in which the SRSCM cannot function and thus cannot control the operation of the standard warning lamp. In these cases, the standard warning lamp is directly activated by appropriate circuitry that operates independently of the SRSCM. These cases are:

1. Loss of battery supply to the SRSCM : warning lamp turned on continuously.

2. Loss of internal operating voltage : warning lamp turned on continuously.
3. Loss of Microprocessor operation : warning lamp turned on continuously.
4. SRSCM not connected : warning lamp turned on continuously through the shorting bar.

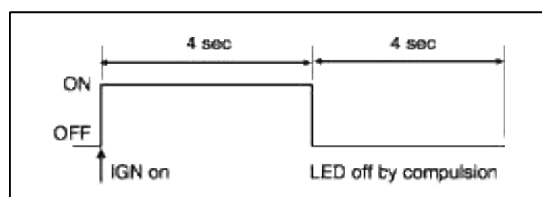
#### TELLTALE LAMP ACTIVATION

The Telltale Lamp indicates the Passenger Airbag(PAB) enabled and disabled status based on occupant status of passenger seat. If the passenger seat is empty or occupied with child (or child seat), the Passenger Airbag is disabled and the Telltale Lamp is turned ON to inform the driver that the PAB is disabled. As soon as operating voltage is applied to the SRSCM ignition input, the SRSCM activates telltale lamp prove out. OCS will send an defect status to the SRSCM as a default setting for passenger airbag deployment during the prove out period.

Occupant status information and telltale status are as indicated below table.

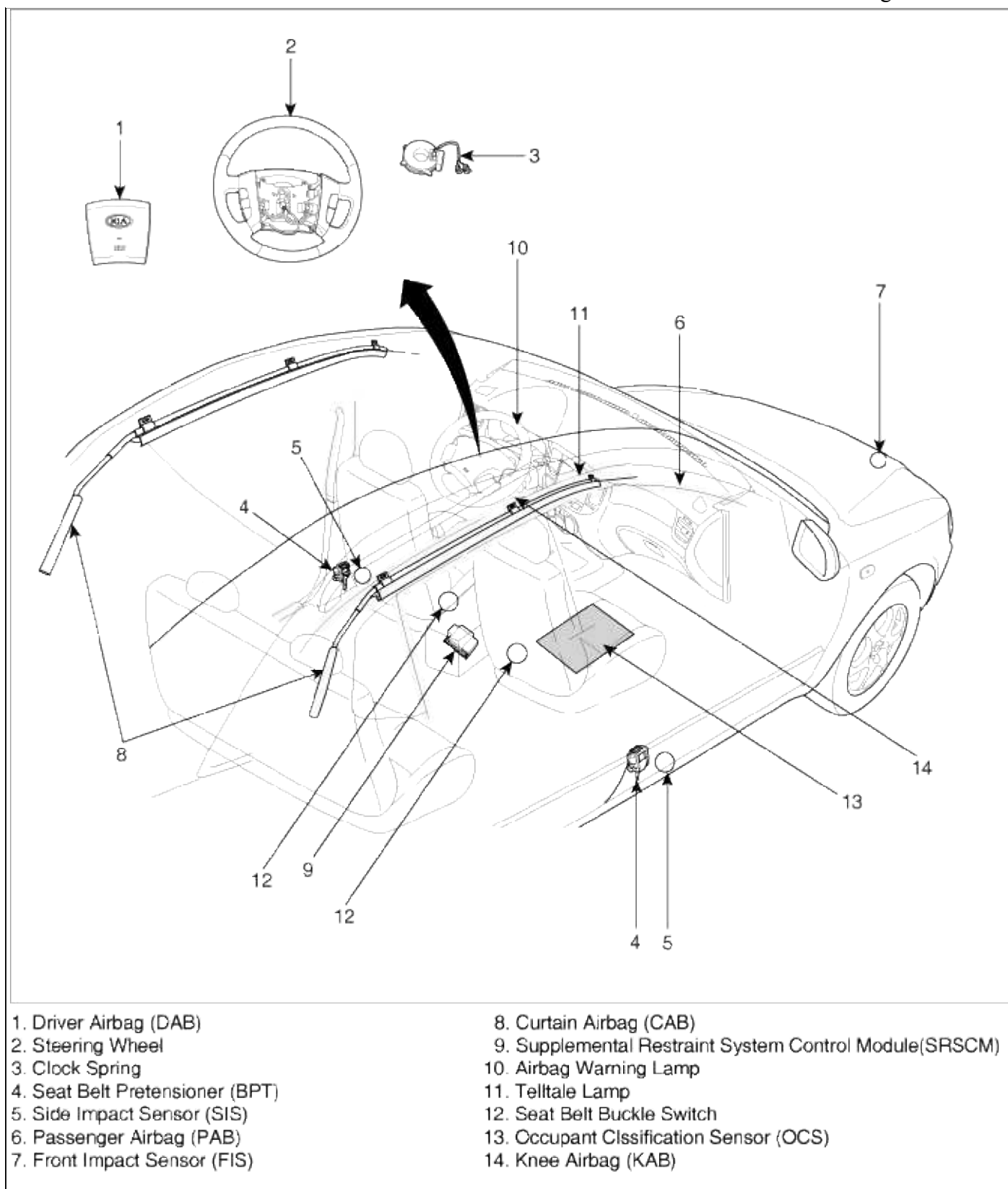
Occupant Status	Telltale Lamp	PAB
Empty	ON	Disabled
Child (Small Occupant)	ON	Disabled
Adult (Large Occupant)	OFF	Enabled

After ignition on, telltale lamp will turn on for 4 seconds and turn off for 4 seconds during the initialization phase and be turned off afterward until receipt of first valid suppression message from OCS system.



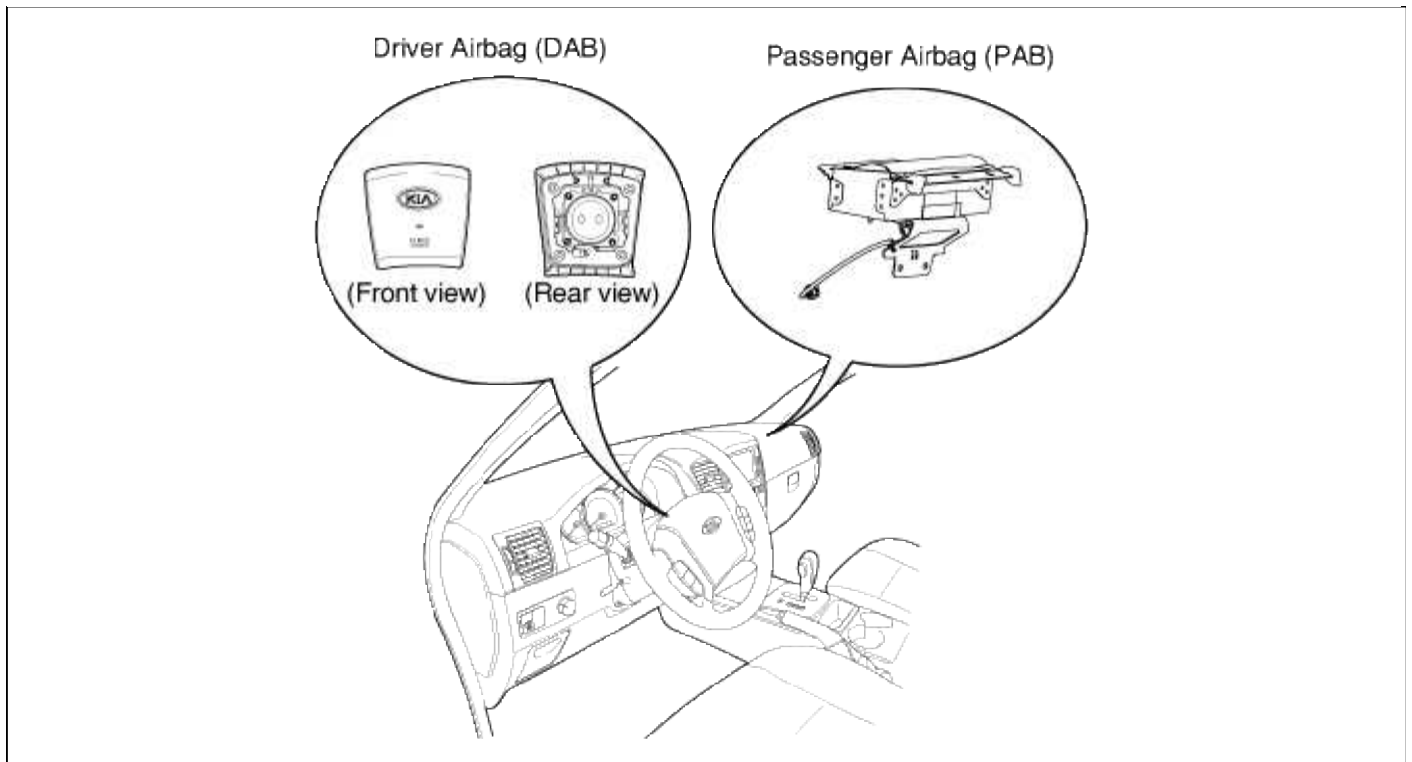
#### Restraint > General Information > Components and Components Location

##### COMPONENTS

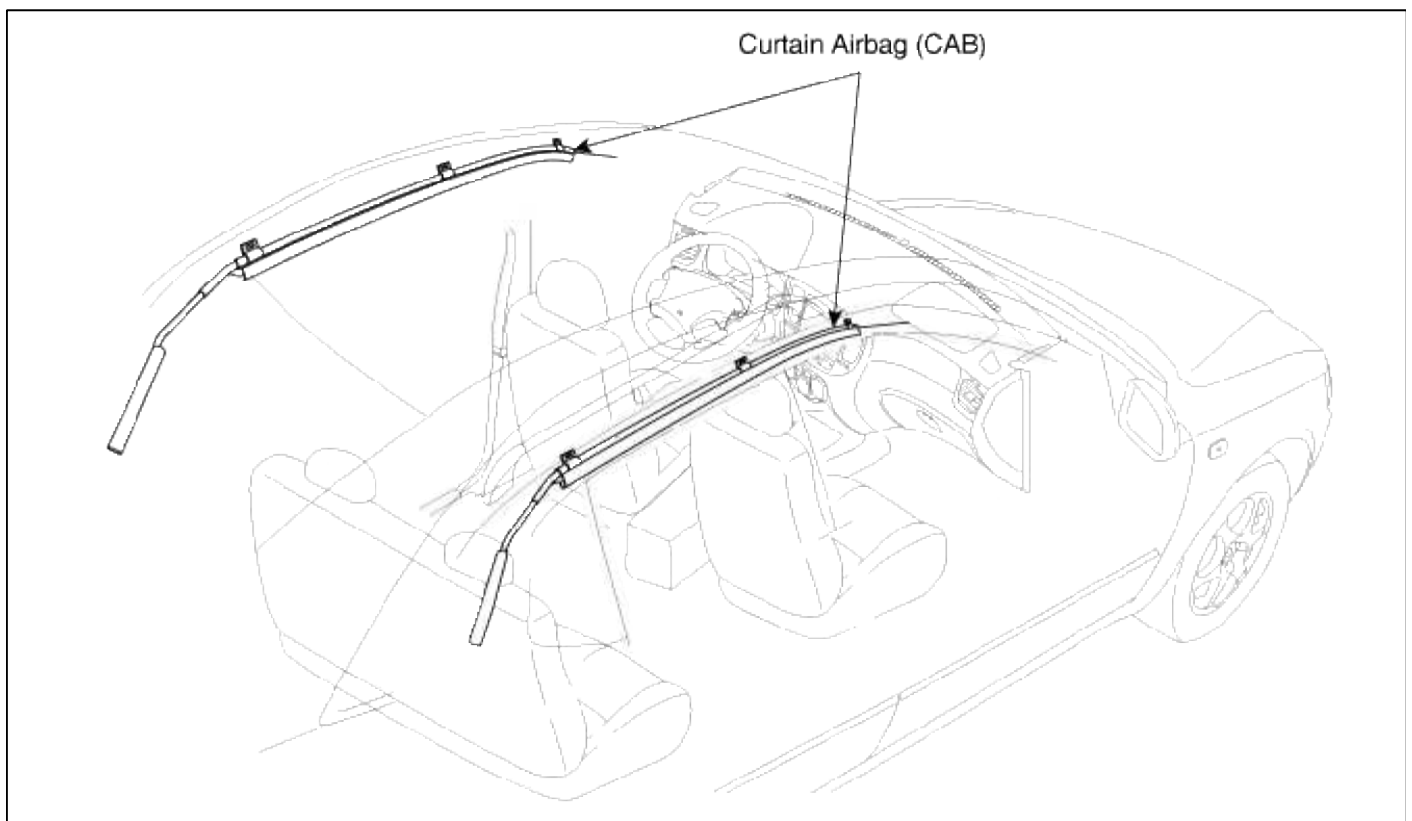


## COMPONENTS LOCATION

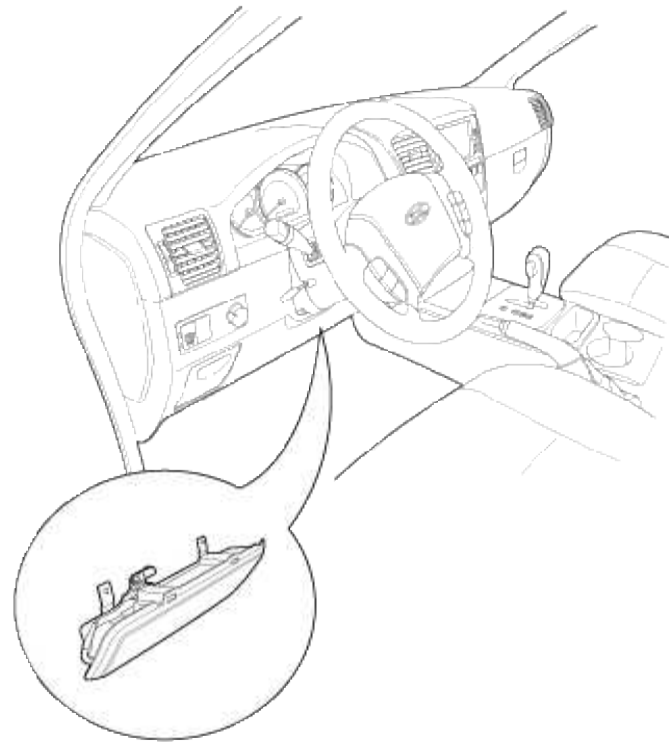
DRIVER AIRBAG (DAB) / PASSENGER AIRBAG (PAB)



## CURTAIN AIRBAG (CAB)



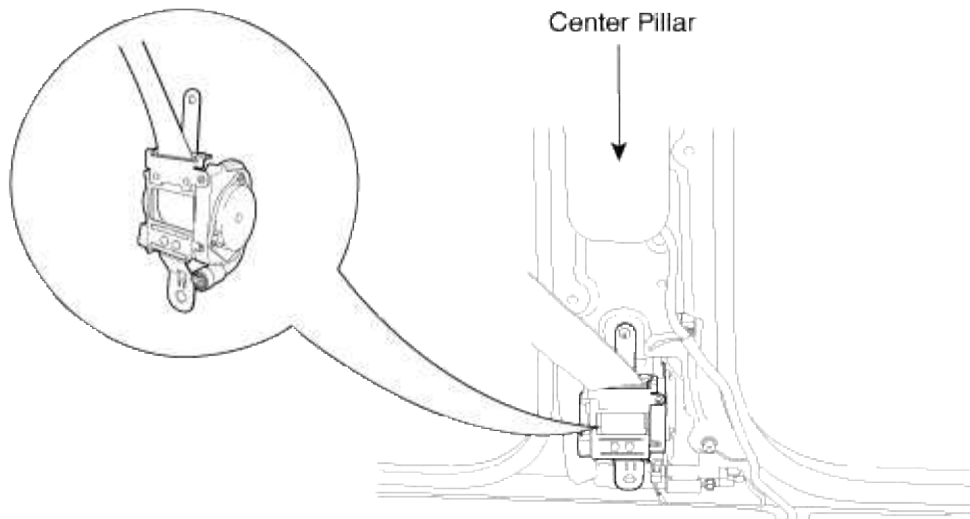
## KNEE AIRBAG (KAB)



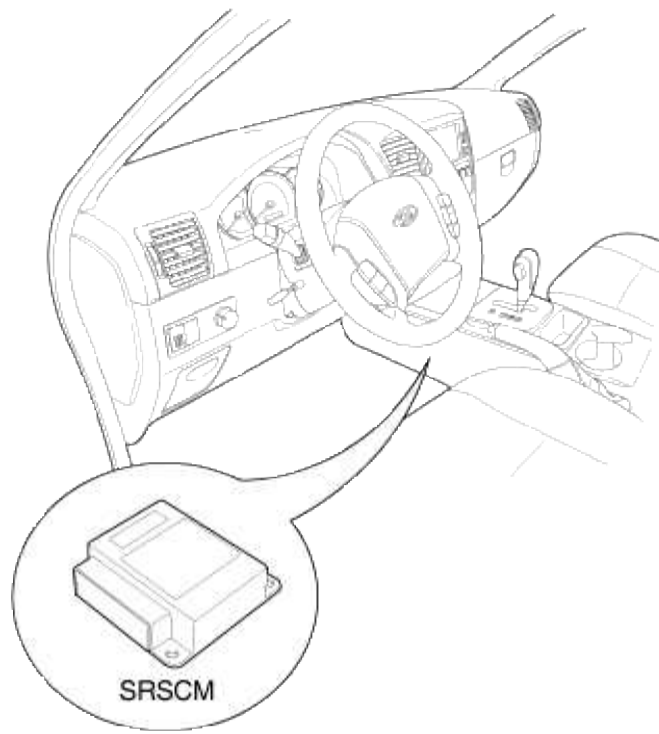
Knee Airbag (KAB)

## SEAT BELT RETRACTOR PRETENSIONER (BPT)

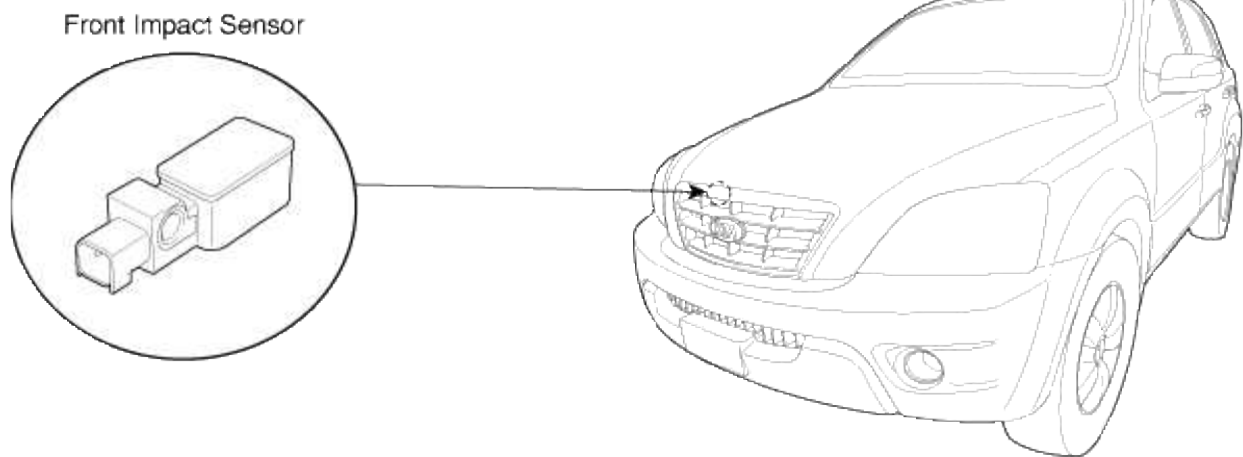
Seat Belt Retractor Pretensioner (BPT)



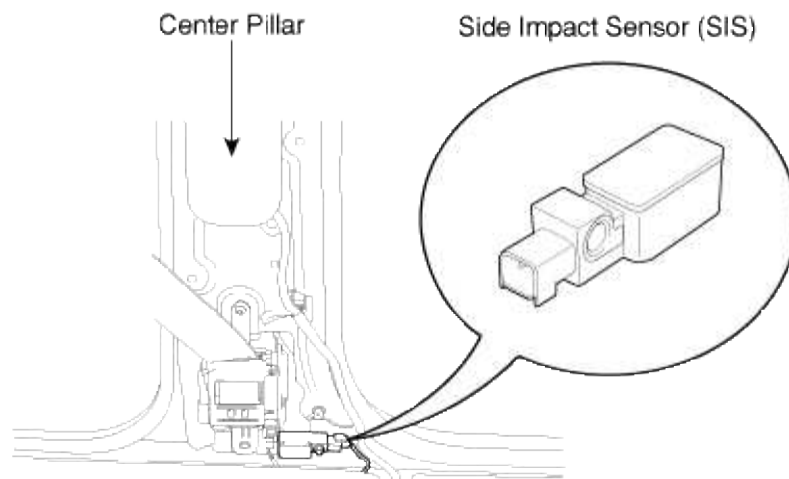
## SUPPLEMENTAL RESTRAINT SYSTEM CONTROL MODULE (SRSCM)



#### FRONT IMPACT SENSOR (FIS)



#### SIDE IMPACT SENSOR (SIS)



## Restraint > General Information > Repair procedures

### COMPONENT REPLACEMENT AFTER DEPLOYMENT

#### NOTE

Before doing any SRS repairs, use the Hi-Scan Pro to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
  - Deployed airbag(s)
  - Seat belt pretensioner(s)
  - Front impact sensor
  - SRS wiring harnesses
  - Inspect the clock spring for heat damage.
- If any damage found, replace the clock spring.

When the seat belt pretensioner(s) deployed after a collision, replace the following items.

- Seat belt pretensioner(s)
- SRSCM (if B1658 detected)
- Front impact sensor
- SRS wiring harnesses

When the curtain airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

After the vehicle is completely repaired, confirm the SRS airbag system is OK.

- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

**Restraint > General Information > Specifications****SPECIFICATION**

ITEM	CONDITION	SPECIFICATION	
Driver Airbag (DAB)	Resistance (Ω)	DAB Stage #1	1.4 ~ 6.0 Ω
		DAB Stage #2	
Passenger Airbag (PAB)	Resistance (Ω)	PAB Stage #1	1.4 ~ 6.0 Ω
		PAB Stage #2	
Knee Airbag (KAB)	Resistance (Ω)	1.4 ~ 4.5 Ω	
Curtain Airbag (CAB)	Resistance (Ω)	1.4 ~ 4.5 Ω	
Seat Belt Pretensioner (BPT)	Resistance (Ω)	1.4 ~ 4.5 Ω	
Seat Belt Buckle Switch (BS)	Current (mA)	Buckled	12.0 ~ 17.0 mA
		Unbuckled	4.0 ~ 7.0 mA

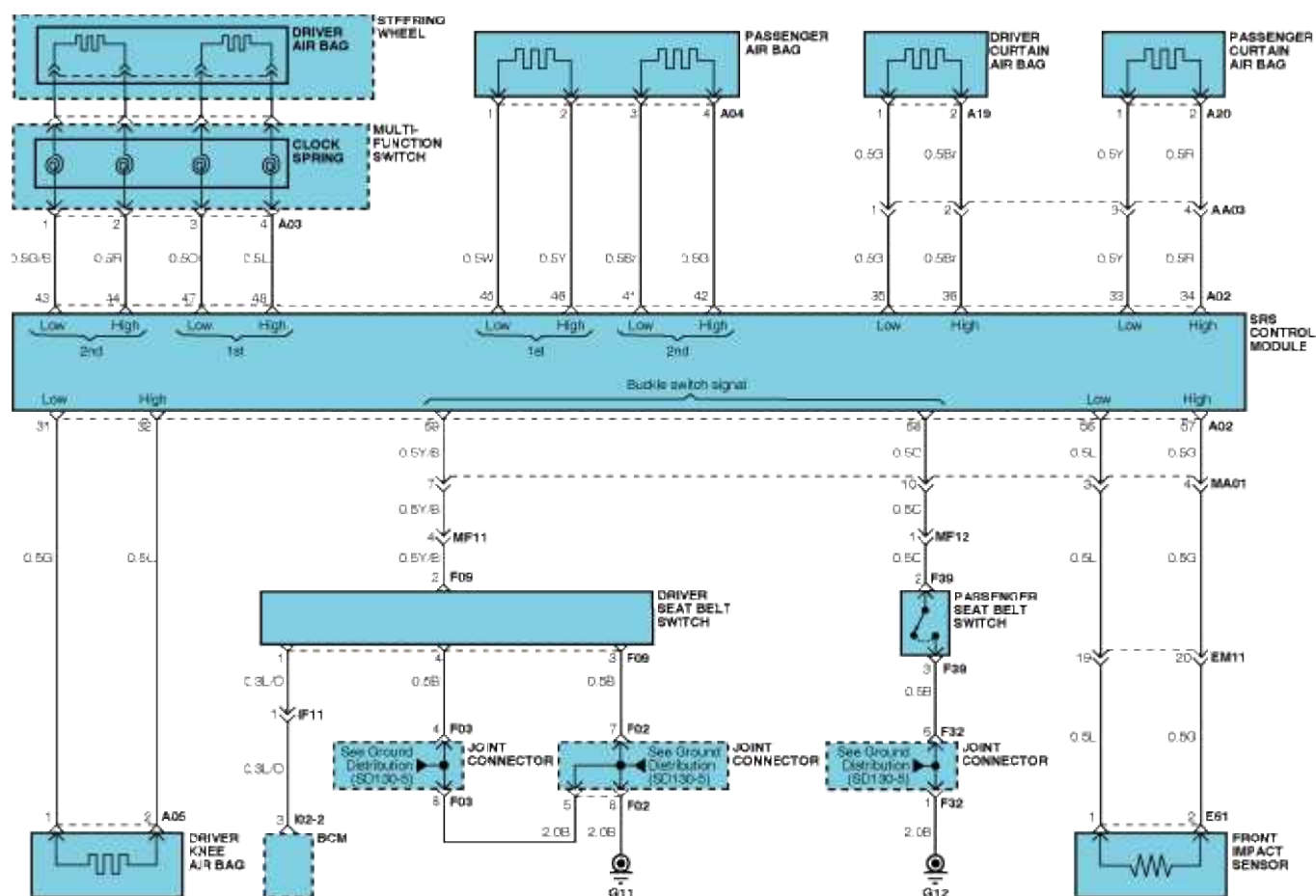
**TIGHTENING TORQUES**

Item	kgf·m	Nm	lb-ft
Driver Airbag (DAB)	0.8 ~ 1.1	7.9 ~ 10.8	5.8 ~ 8.0
Passenger Airbag (PAB)	Bolt : 1.9 ~ 2.7	18.6 ~ 26.5	13.7 ~ 19.5
	Nut : 0.9 ~ 1.4	8.8 ~ 13.7	6.5 ~ 10.1
Curtain Airbag (CAB)	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Knee Airbag (KAB)	0.8 ~ 1.2	7.8 ~ 11.8	5.0 ~ 5.2
Seat Belt Anchor Bolt (BPT)	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
SRSCM Mounting Bolt	1.0 ~ 1.4	10.2 ~ 13.8	7.5 ~ 10.2
Front Impact Sensor (FIS) Mounting Bolt	1.0 ~ 1.4	10.2 ~ 13.8	7.5 ~ 10.2
Side Impact Sensor (SIS) Mounting Bolt	1.0 ~ 1.4	10.2 ~ 13.8	7.5 ~ 10.2

**Restraint > Supplemental Restraint System Control Module (SRnodeM) > Schematic Diagrams****CIRCUIT DIAGRAM**


















SRSCM CONNECTOR TERMINAL

SRSCM HARNESS CONNECTOR

1																								
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75

Shorting bar (): located on the upper side of pin number from 2 to 25 of SRSCM connector.

Note: For short circuit check, shorting bar must be opened. Use a plastic clip as a shorting bar opener for disconnecting shorting bar.

Pin	Function	Pin	Function
1	-	50	Power Ground
2~25	Shorting Bar	51	Side Impact Sensor [Front-Passenger] Low
26	-	52	Side Impact Sensor [Front-Passenger] High
27	-	53	Side Impact Sensor [Front-Driver] Low
28	-	54	Side Impact Sensor [Front-Driver] High
29	-	55	Front Impact Sensor [Center] Low
30	-	56	Front Impact Sensor [Center] High
31	Knee Airbag [Driver] Low	57	-
32	Knee Airbag [Driver] High	58	-
33	Curtain Airbag [Passenger] High	59	-
34	Curtain Airbag [Passenger] Low	60	-
35	Curtain Airbag [Driver] Low	61	-
36	Curtain Airbag [Driver] High	62	-
37	Seat Belt Pretensioner [Front-Passenger] Low	63	-
38	Seat Belt Pretensioner [Front-Passenger] High	64	-
39	Seat Belt Pretensioner [Front-Driver] Low	65	-
40	Seat Belt Pretensioner [Front-Driver] High	66	-
41	(2nd Stage) Passenger Airbag Low	67	-
42	(2nd Stage) Passenger Airbag High	68	Seat Belt Buckle Switch [Passenger]
43	(2nd Stage) Driver Airbag Low	69	Seat Belt Buckle Switch [Driver]
44	(2nd Stage) Driver Airbag High	70	Occupant Classification Sensor (OCS)
45	(1st Stage) Passenger Airbag Low	71	-
46	(1st Stage) Passenger Airbag High	72	Crash Output
47	(1st Stage) Driver Airbag Low	73	K-Line Diagnostic
48	(1st Stage) Driver Airbag High	74	Telltale Warning Lamp
49	Airbag Warning Lamp	75	Ignition

#### DIAGNOSTIC TROUBLE CODES (DTC)

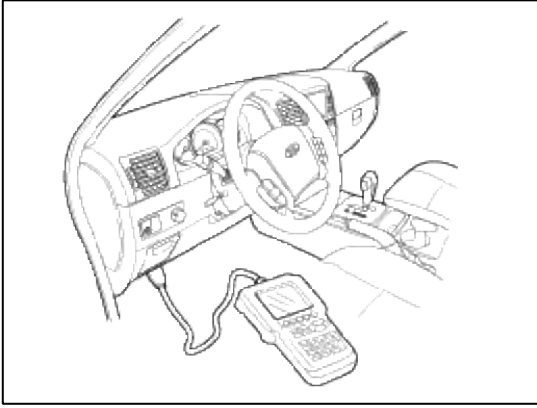
DTC	FAULT DESCRIPTION	REMARK
B1101	Battery Voltage High	
B1102	Battery Voltage Low	
B1338	Front Impact Sensor [Center] Defect	
B1339	Front Impact Sensor [Center] Communication Error	

B1346	Driver Airbag Resistance too High (1st Stage)	
B1347	Driver Airbag Resistance too Low (1st Stage)	
B1348	Driver Airbag Resistance Circuit Short to Ground (1st Stage)	
B1349	Driver Airbag Resistance Circuit Short to Battery (1st Stage)	
B1352	Passenger Airbag Resistance too High (1st Stage)	
B1353	Passenger Airbag Resistance too Low (1st Stage)	
B1354	Passenger Airbag Resistance Circuit Short to Ground (1st Stage)	
B1355	Passenger Airbag Resistance Circuit Short to Battery (1st Stage)	
B1361	Seat Belt Pretensioner [Front-Driver] Resistance too High	
B1362	Seat Belt Pretensioner [Front-Driver] Resistance too Low	
B1363	Seat Belt Pretensioner [Front-Driver] Resistance Circuit Short to Ground	
B1364	Seat Belt Pretensioner [Front-Driver] Resistance Circuit Short to Battery	
B1367	Seat Belt Pretensioner [Front-Passenger] Resistance too High	
B1368	Seat Belt Pretensioner [Front-Passenger] Resistance too Low	
B1369	Seat Belt Pretensioner [Front-Passenger] Resistance Circuit Short to Ground	
B1370	Seat Belt Pretensioner [Front-Passenger] Resistance Circuit Short to Battery	
B1400	Side Impact Sensor [Front-Driver] Defect	
B1403	Side Impact Sensor [Front-Passenger] Defect	
B1409	Side Impact Sensor [Front-Driver] Communication Error	
B1410	Side Impact Sensor [Front-Passenger] Communication Error	
B1447	Occupant Classification (OC) [Passenger] ECU Defect	
B1448	Occupant Classification (OC) [Passenger] Sensor Mat Defect	
B1449	Occupant Classification (OC) [Passenger] Communication Error	
B1450	Occupant Classification (OC) [Passenger] Wrong ID	
B1473	Curtain Airbag [Front-Driver] Resistance too High	
B1474	Curtain Airbag [Front-Driver] Resistance too Low	
B1475	Curtain Airbag [Front-Driver] Resistance Circuit Short to Ground	
B1476	Curtain Airbag [Front-Driver] Resistance Circuit Short to Battery	
B1477	Curtain Airbag [Front-Passenger] Resistance too High	
B1478	Curtain Airbag [Front-Passenger] Resistance too Low	
B1479	Curtain Airbag [Front-Passenger] Resistance Circuit Short to Ground	
B1480	Curtain Airbag [Front-Passenger] Resistance Circuit Short to Battery	
B1481	Driver Airbag Resistance too High (2nd Stage)	

B1482	Driver Airbag Resistance too Low (2nd Stage)	
B1483	Driver Airbag Resistance Circuit Short to Ground (2nd Stage)	
B1484	Driver Airbag Resistance Circuit Short to Battery (2nd Stage)	
B1485	Passenger Airbag Resistance too High (2nd Stage)	
B1486	Passenger Airbag Resistance too Low (2nd Stage)	
B1487	Passenger Airbag Resistance Circuit Short to Ground (2nd Stage)	
B1488	Passenger Airbag Resistance Circuit Short to Battery (2nd Stage)	
B1511	Seat Belt Buckle Switch [Driver] Open or Short to Battery	
B1512	Seat Belt Buckle Switch [Driver] Short or Short to Ground	
B1513	Seat Belt Buckle Switch [Passenger] Open or Short to Battery	
B1514	Seat Belt Buckle Switch [Passenger] Short or Short to Ground	
B1515	Seat Belt Buckle Switch [Driver] Defect	
B1516	Seat Belt Buckle Switch [Passenger] Defect	
B1517	Seat Belt Buckle Switch [Driver] Instability	
B1518	Seat Belt Buckle Switch [Passenger] Instability	
B1620	Supplemental Restraint System Control Module Internal Fault (Replace SRSCM)	
B1650	Crash Recorded in 1st stage only - Frontal (Replace SRSCM)	
B1651	Crash Recorded in Driver Curtain Airbag (Replace SRSCM)	
B1652	Crash Recorded in Passenger Curtain Airbag (Replace SRSCM)	
B1655	Crash Recorded with passenger side inhibited by suppression system	
B1657	Crash Recorded in Belt Pretensioner Only	
B1658	Belt Pretensioner 6 times Deployment (Replace SRSCM)	
B1670	Crash recorded in Full Stage - Frontal (Replace SRSCM)	
B1711	Knee Airbag [Driver] Resistance too High	
B1712	Knee Airbag [Driver] Resistance too Low	
B1713	Knee Airbag [Driver] Resistance Circuit Short to Ground	
B1714	Knee Airbag [Driver] Resistance Circuit Short to Battery	
B2503	SRS Warning Lamp Open or Short to Ground	
B2504	SRS Warning Lamp Short or Short to Battery	
B2507	Passenger Airbag Telltale Lamp Open or Short to Ground	
B2508	Passenger Airbag Telltale Lamp Short or Short to Battery	

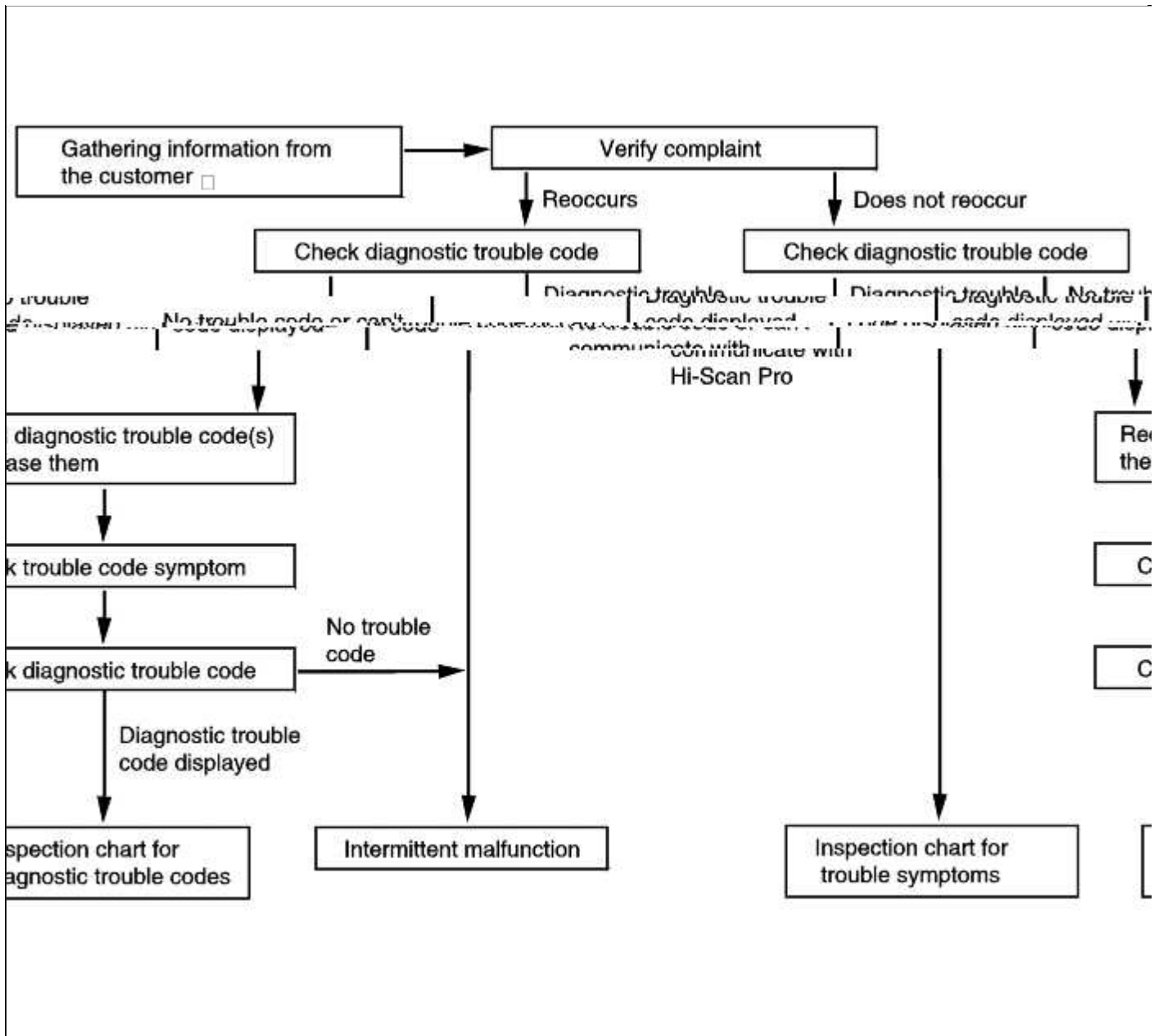
**Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting**
**DESCRIPTION**
**HI-SCAN CHECK**

1. Turn the ignition switch off.
2. Connect the Hi-Scan Pro connector to the data link connector located under the crash pad.



3. Turn the ignition switch on and power on the Hi-Scan Pro.
4. Read DTCs.
5. Find and repair the trouble, and clear the DTCs using Hi-Scan Pro.
6. Disconnect the Hi-Scan Pro.
7. Confirm proper system operation ;
  - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

#### DIAGNOSTIC TROUBLESHOOTING FLOW



### TERMINAL & CONNECTOR INSPECTION

Be sure to perform "TERMINAL & CONNECTOR INSPECTION" before doing "INSPECTION PROCEDURE" for troubleshooting of each DTC.

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

#### CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

**NO**

Go to next step (INSPECTION PROCEDURE).

**YES**

After repairing the trouble part, check whether DTC occurs or not.

### PREPARATION OF INSPECTION

Refer to the following steps while doing "INSPECTION PROCEDURE" which is described in the DTC troubleshooting section.

1. Turn the ignition switch to LOCK.
2. Disconnect the battery negative cable from the battery and wait for at least 3 minutes.
3. Remove the DAB module and disconnect the DAB connector.
4. Disconnect the connectors of the PAB, CAB, KAB, BPT, FIS and SIS.
5. Disconnect the SRSCM connector.

#### CHECKING OF SHORT OR OPEN CIRCUIT

Refer to the following tips for checking of short or open circuit.

1. Shorting bar is located on the upper side of pin number from 2 to 25 of SRSCM connector.
2. When checking for a short circuit, the shorting bar must be opened. Use a plastic clip to put into as a shorting bar opener for disconnecting shorting bar.
3. Use SST Dummy adapter (0957A-2G000) to measure resistance or voltage for checking of short or open circuit.

Plug it into DAB (BPT) connector to avoid enlarging or damaging the connector pins.

#### CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

1. Install the DAB module and connect the DAB connector.
2. Connect the connector of the PAB, CAB, BPT, FIS and SIS.
3. Connect the SRSCM connector.
4. Connect the battery negative cable to the battery.
5. Connect a Hi-Scan(Pro) to the data link connector.
6. Turn the ignition switch to ON.
7. Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro)
8. Turn the ignition switch to LOCK and wait for at least 30 seconds.
9. Turn the ignition switch to ON and wait for at least 30 seconds.
10. Check the vehicle again with the Hi-Scan(Pro).

Does the above DTC(s) go off?

**YES**

Problem is intermittent or was repaired and SRSCM memory was not cleared.

**NO**

Replace the SRSCM with a new one and then check the vehicle again. At this time, if the vehicle normally operates with a new one, the fault may be the SRSCM. Replace the SRSCM.

### **Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Description and Operation**

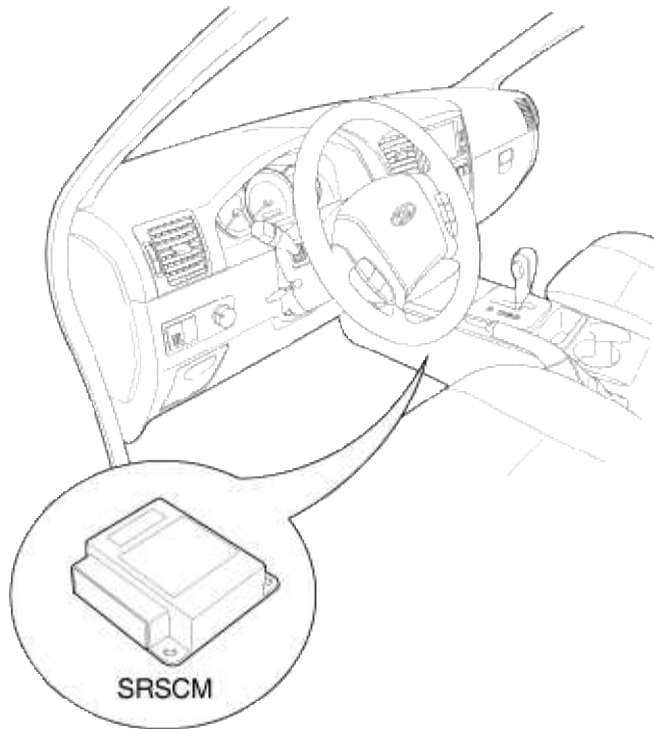
#### DESCRIPTION

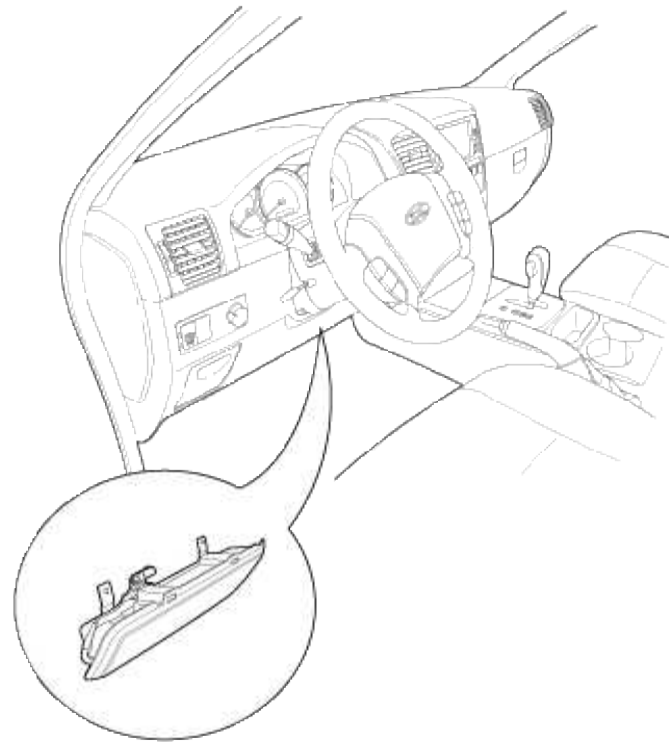
The primary purpose of the SRSCM (Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag deployment is required, the SRSCM must supply sufficient power to the pretensioners and airbag igniters to initiate deployment. The SRSCM determines that an impact may require deployment of the pretensioners and airbags from data obtained from impact sensors and other components in conjunction with a safing function. The SRSCM will not be ready to detect a crash or to activate the restraint system devices until the signals in the SRSCM circuitry stabilize. It is possible that the SRSCM could activate the safety restraint devices in approximately 2 seconds but is guaranteed to fully function after prove-out is completed. The SRSCM must perform a diagnostic routine and light a system readiness indicator at key-on. The system must perform a continuous diagnostic routine and provide fault annunciation through a warning lamp indicator in the event of fault detection. A serial diagnostic communication interface will be used to facilitate servicing of the restraint control system.



**CAUTION**

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

**Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Components and Components Location****COMPONENTS****COMPONENTS**

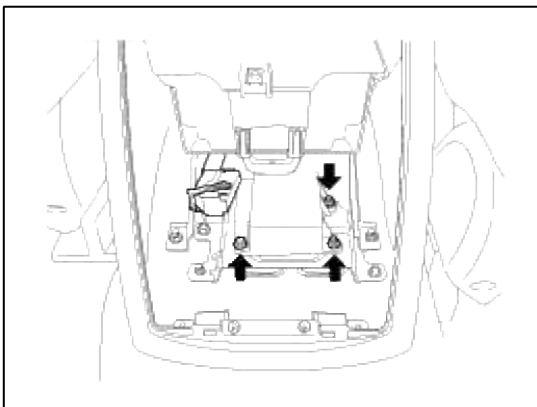


Knee Airbag (KAB)

### **Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Repair procedures**

#### **REMOVAL**

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Disconnect the DAB, PAB, KAB, CAB and BPT connectors.
4. Remove the console lid cover. (Refer to BD group)
5. Disconnect the SRSCM harness connector after pulling the connector locking lever.

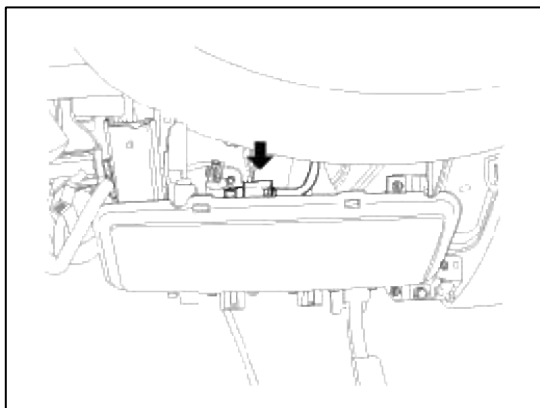


6. Remove the SRSCM mounting bolt (1EA) and nuts (2EA) from the SRSCM, then remove the SRSCM.

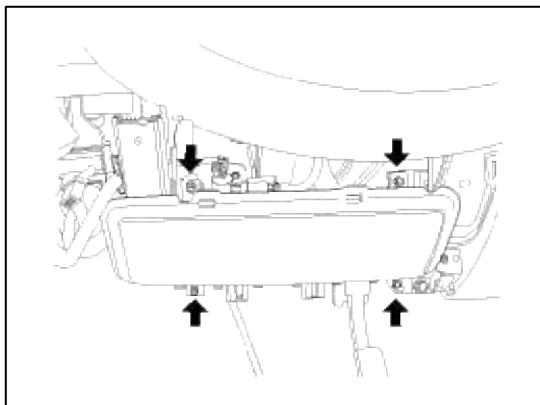
#### **REMOVAL**

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the following parts. (Refer to BD group)
  - A. Crash pad lower panel

3. Disconnect the Knee Airbag harness connector.



4. After loosening the mounting nuts(4EA) remove the knee airbag.



## INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Install the SRSCM with the SRSCM mounting bolt and nuts.

---

Tightening torque (SRSCM Mounting bolt)  
: 1.0 ~ 1.4 kgf.m (10.2 ~ 13.8 Nm, 7.5 ~ 10.2 lb.ft)

---

### NOTE

Use new mounting bolts when replacing the SRSCM after a collision.

4. Connect the SRSCM harness connector completely with pushing the connector locking lever.
5. Install the console lid cover. (Refer to BD group)
6. Connect the DAB, PAB, KAB, CAB and BPT connectors.
7. Reconnect the battery negative cable.
8. After installing the SRSCM, confirm proper system operation:
  - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

## INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Connect the KAB connector.

#### 4. Tighten the KAB mounting nuts (4EA).

Tightening torque

: 1.9 ~ 2.7 kgf.m(18.6 ~ 26.7 Nm, 13.7 ~ 19.8 lb.ft)

#### CAUTION

- Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.

#### 5. Install the following parts. (Refer to BD group)

A. Crash pad lower panel.

#### 6. Reconnect the battery negative cable.

#### 7. After installing the Knee Airbag (KAB), confirm proper system operation:

A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

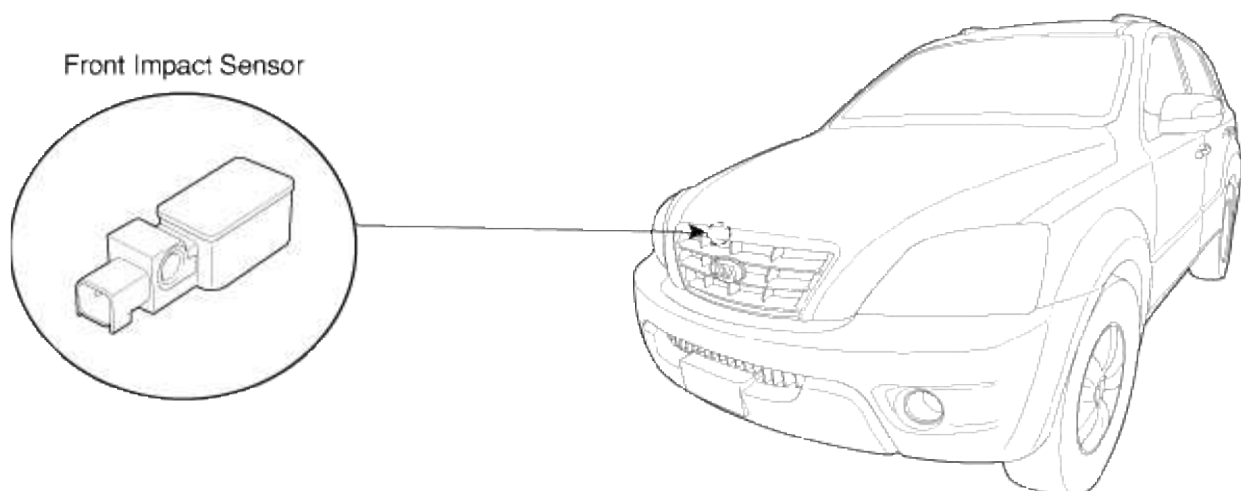
### Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Description and Operation

#### DESCRIPTION

The front impact sensor (FIS) is installed in the side member. They are remote sensors that detect acceleration due to a collision at its mounting location. The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collision. The Front Impact Sensor(FIS) sends acceleration data to the SRSCM.

### Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Components and Components Location

#### COMPONENTS



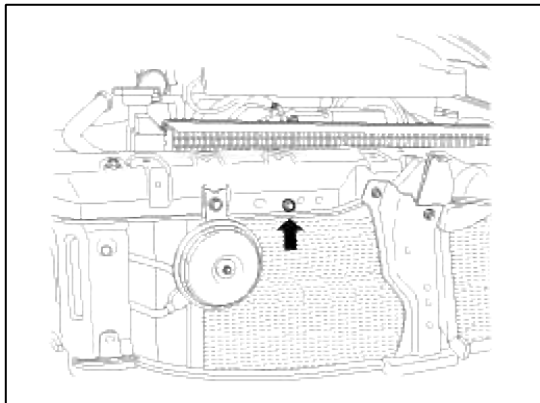
## Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Repair procedures

### REMOVAL

#### CAUTION

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the Front bumper seal board.
3. Remove the Front Impact Sensor mounting bolt.



4. Disconnect the Front Impact Sensor connector.

### INSTALLATION

#### CAUTION

- Do not turn the ignition switch ON and do not contact the battery cable while replacing the front impact sensor.

1. Install the new Front Impact Sensor.
2. Tighten the Front Impact Sensor mounting bolt.

Tightening torque

: 1.0 ~ 1.4 kgf.m (10.2 ~ 13.8 Nm, 7.5 ~ 10.2 lb.ft)

3. Connect the Front Impact Sensor connector.
4. Install the Front bumper seal board.
5. Reconnect the battery negative cable.
6. After installing the Front Impact Sensor, confirm proper system operation: Turn the ignition switch ON the SRS indicator light should be turned on for about six seconds and then go off.

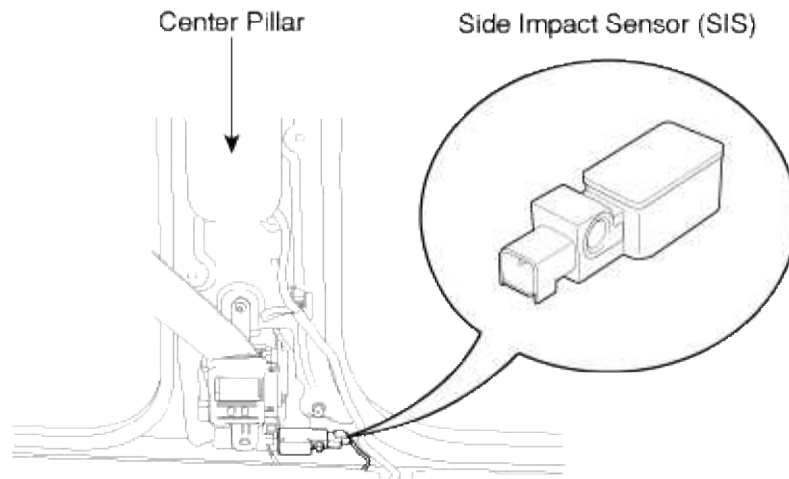
## Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Description and Operation

### DESCRIPTION

The Side Impact Sensor (SIS) system consists of two front SIS which are installed in the center pillar (LH and RH). They are remote sensors that detect acceleration due to collision at their mounting locations. The primary purpose of the Side Impact Sensor (SIS) is to provide an indication of a collision. The Side Impact Sensor (SIS) sends acceleration data to the SRSCM.

## Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Components and Components Location

### COMPONENTS



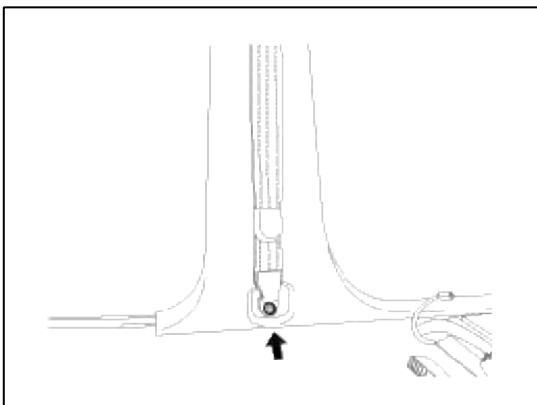
## Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Repair procedures

### REMOVAL

#### CAUTION

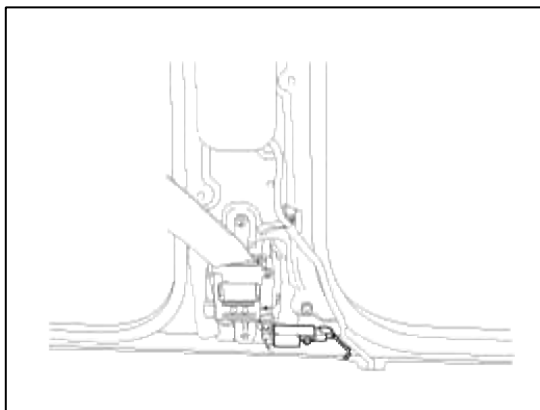
- Removal of the airbag must be performed according to the precautions/procedures described previously.
- Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the lower anchor bolt.



3. Remove the following parts. (Refer to BD group)
  - A. Door scuff trim, Center pillar trim

4. Disconnect the Side Impact Sensor connector and remove the Side Impact Sensor mounting bolt.



## INSTALLATION

### CAUTION

- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new Side Impact Sensor with the bolt then connect the SRS harness connector to the Side Impact Sensor.

Tightening torque

: 1.0 ~ 1.4 kgf.m (10.2 ~ 13.8 Nm, 7.5 ~ 10.2 lb.ft)

2. Install the center pillar trim. (Refer to BD group)
3. Install the door scuff trim. (Refer to BD group)
4. Install the lower anchor bolt.
5. Reconnect the battery negative cable.
6. After installing the Side Impact Sensor, confirm proper system operation: Turn the ignition switch ON, the SRS indicator light should be turned on for about six seconds and then go off.

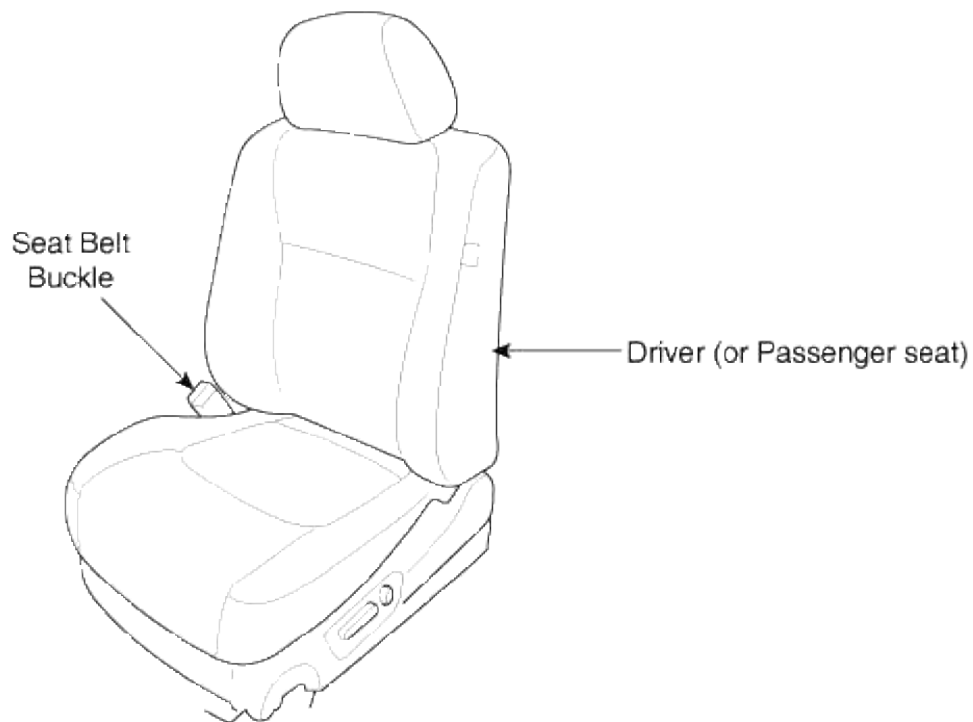
## **Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Belt Buckle Switch (BS) > Description and Operation**

### DESCRIPTION

The buckle status shall modify the SRSCM deployment. If the Buckle Status is Unbuckled, the corresponding pretensioner will be deactivated.

## **Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Belt Buckle Switch (BS) > Components and Components Location**

### COMPONENTS



### **Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Description and Operation**

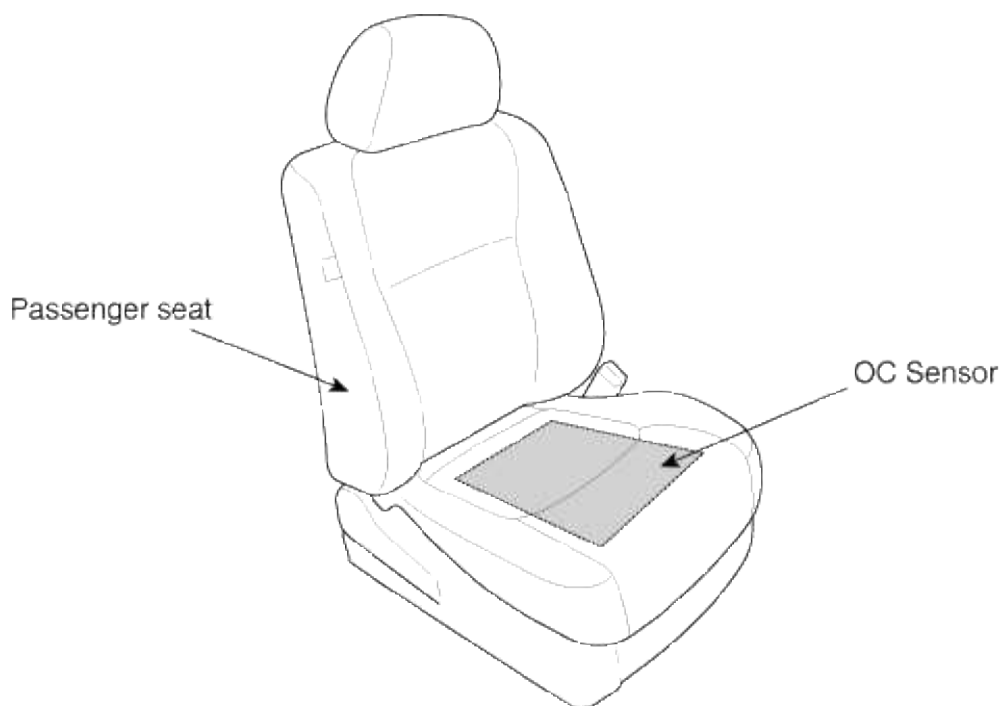
#### **DESCRIPTION**

In contrast to the initial one-stage airbag systems, newer restraint systems involve complex logic to select, or alternatively suppress, various levels of safety system deployment. Inherent to an Advanced Restraint System is the ability to discern information regarding passenger occupancy. It is intended that these inputs be provided through the OC system. The objective of such safety system is to reduce the risk and level of injuries by automatically adapting the airbag(s) and seat belt pretensioner to the driving status of the vehicle, its occupants, and the crash severity. The current OC system covered in this specification continually senses and classifies the front passenger side seat.

### **Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Components and Components Location**

#### **COMPONENTS**





## Restraint > Airbag Module > Description and Operation

### AIRBAG DISPOSAL

#### SPECIAL TOOL REQUIRED

Before scrapping any airbags or side airbags (including those in a whole vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped.

If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

#### DEPLOYING AIRBAGS IN THE VEHICLE

If an SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag is securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.

#### DRIVER'S AIRBAG :

1. Remove the driver's airbag and install the SST(0957A-38500).
2. Install the driver's airbag on the steering wheel.

#### FRONT PASSENGER'S AIRBAG :

1. Remove the glove box, then disconnect the 4P connector between the front passenger's airbag and SRS main harness.
2. Install the SST(0957A-3E110).

#### KNEE AIRBAG :

1. Disconnect the 2P Connector between the knee airbag and wire harness.
2. Install the SST (0957A-3F100).

**CURTAIN AIRBAG :**

1. Disconnect the 2P connector between the curtain airbag and wire harness.
2. Install the SST(0957A-38500).

**SEAT BELT PRETENSIONER :**

1. Disconnect the 2P connector from the seat belt pretensioner.
2. Install the SST(0957A-38500).
3. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
4. Connect a 12 volt battery to the tool.
5. Push the tool's deployment switch. The airbag should deploy (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)
6. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

**DEPLOYING THE AIRBAG OUT OF THE VEHICLE**

If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows :

1. Confirm that the special tool is functioning properly by following the check procedure.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

**DISPOSAL OF DAMAGED AIRBAG**

1. If installed in a vehicle, follow the removal procedure of driver's airbag front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

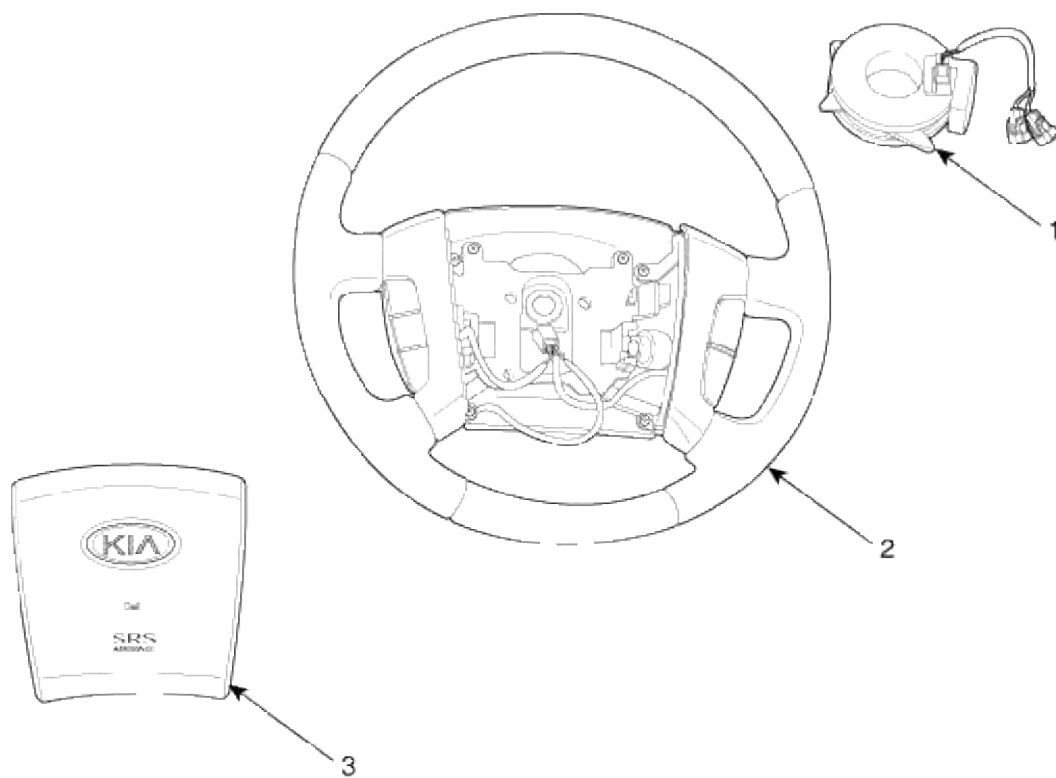
**Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation**
**DESCRIPTION**

Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clockspring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB).

**CAUTION**

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

**Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Components and Components Location**
**COMPONENTS**



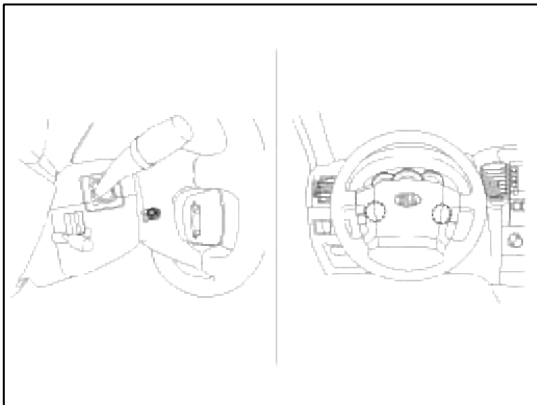
1. Clock Spring  
2. Steering Wheel

3. Driver Airbag (DAB)

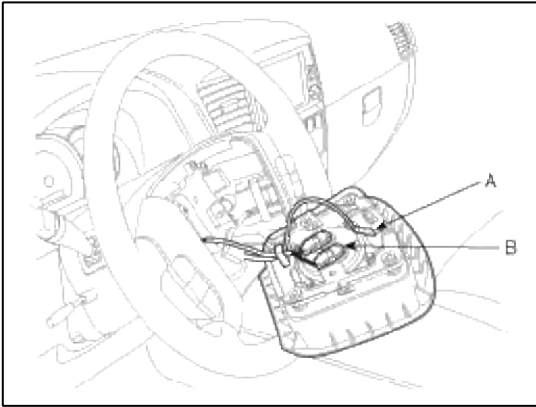
### Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

#### REMOVAL

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the airbag module mounting bolts(2EA).



3. Disconnect the horn connector(A).

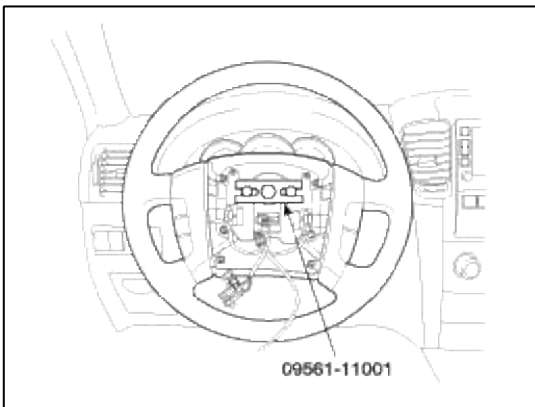


4. Release the connector locking pin, then disconnect the driver airbag module connector(B).

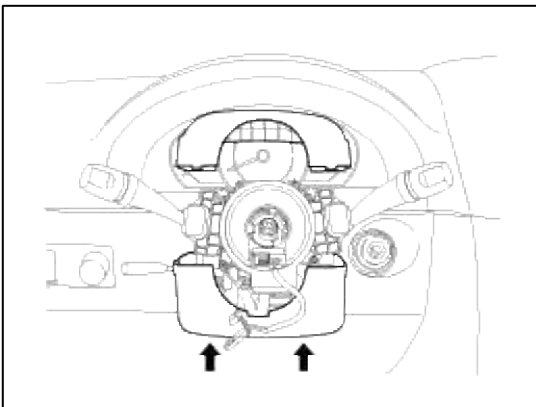
**CAUTION**

The removed airbag module should be stored in a clean, dry place with the pad cover face up.

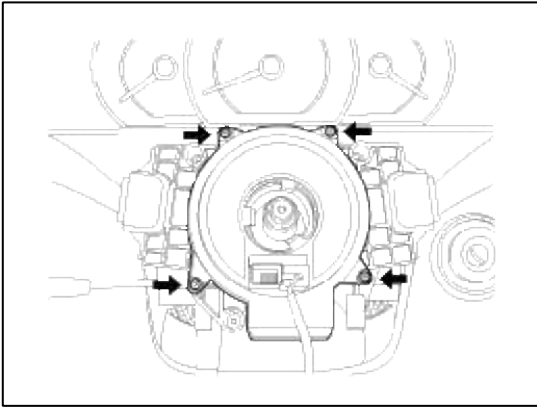
5. Remove the steering wheel with SST (SST No. 09561-11001) after unfastening the mounting nut.



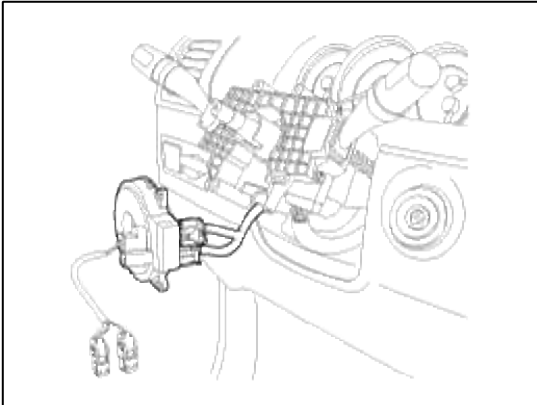
6. Remove the steering wheel column cover after unscrewing 3 screws.



7. Unscrew the clock spring tightening screws. (4EA)

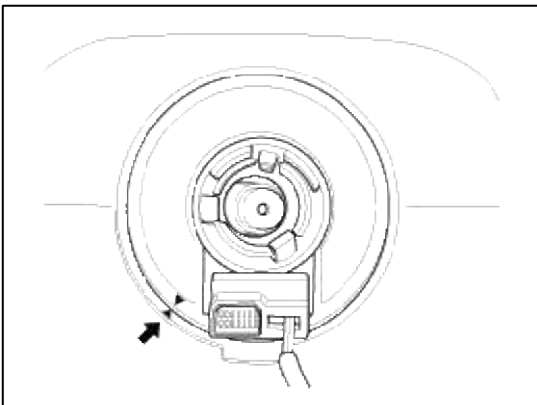


8. Disconnect the clock spring wiring harness and the horn wiring harness connector from the clock spring.



## INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Connect the clock spring harness connector and horn harness connector to the clock spring.
4. Install the clock spring with 4 screws.
5. Set the center position by getting marks between the clock spring and the cover into line. Make an array the mark ( ) by turning the clock spring clockwise to the stop and then 2.4 revolutions counterclockwise.

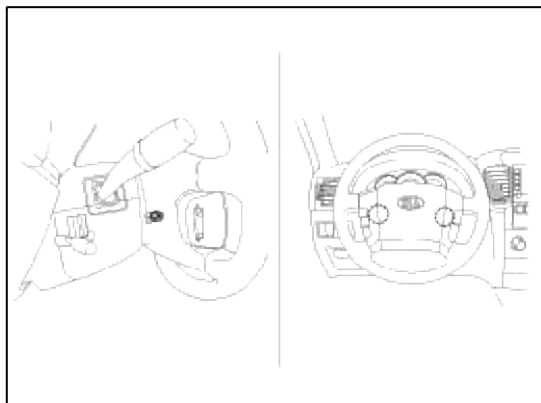


6. Install the steering wheel column cover and the steering wheel. (Refer to ST group)
7. Connect the Driver Airbag (DAB) module connector and horn connector, then install the Driver Airbag (DAB) module on the steering wheel.

8. Secure the Driver Airbag (DAB) with the new mounting bolts.

Tightening torque (DAB Mounting Bolt)

: 0.8 ~ 1.1 kgf.m (7.9 ~ 10.8 Nm, 5.8 ~ 8.0 lb.ft)



9. Connect the battery negative cable.

10. After installing the airbag, confirm proper system operation:

- A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
- B. Make sure horn button works

## INSPECTION

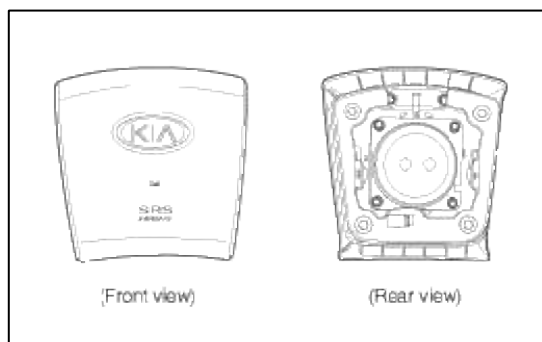
### DRIVER AIRBAG (DAB)

If any improper parts are found during the following inspection, replace the airbag module with a new one.

#### CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.

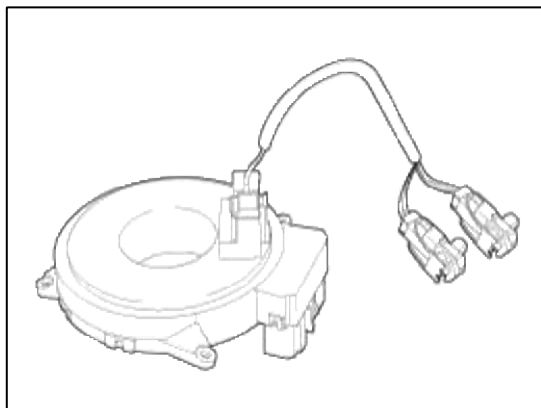


5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

## CLOCKSPRING

1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.

2. Check connectors and protective tube for damage, and terminals for deformities.



## Restraint > Airbag Module > Passenger Airbag (PAB) Module > Description and Operation

### DESCRIPTION

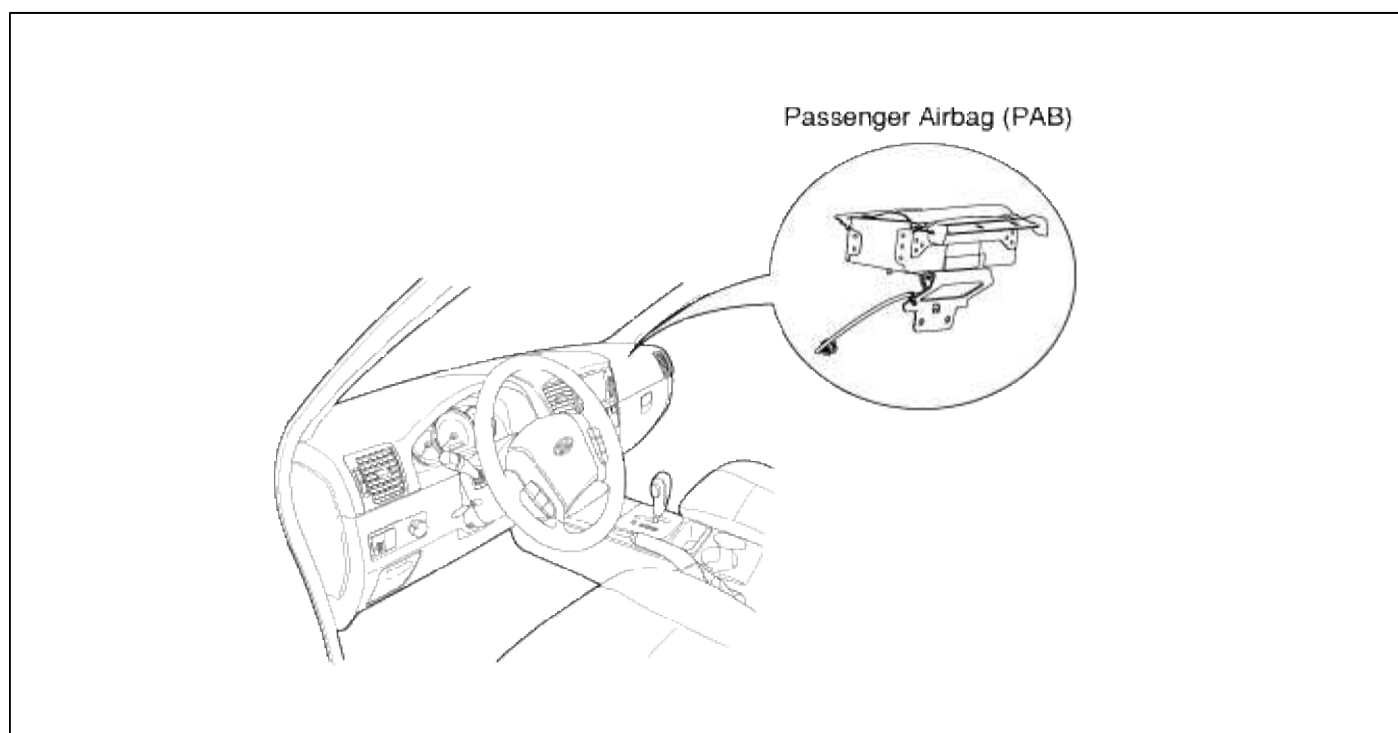
The passenger Airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

#### CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

## Restraint > Airbag Module > Passenger Airbag (PAB) Module > Components and Components Location

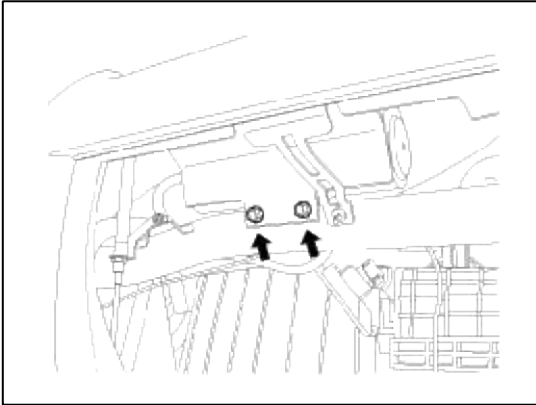
### COMPONENTS



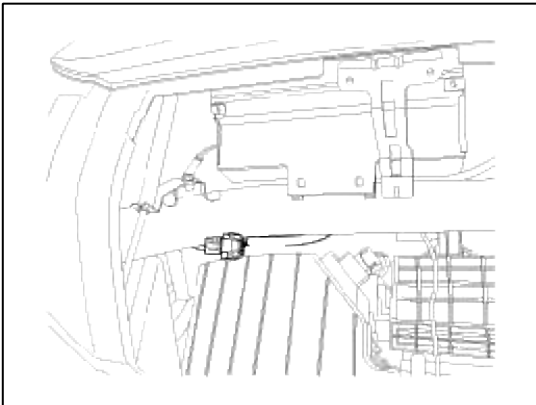
## Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

### REMOVAL

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box. (Refer to BD group)
3. Remove the PAB mounting bolts (2EA).



4. Disconnect the PAB module connector.



5. Remove the crash pad. (Refer to BD group)

**NOTE**

If the crash pad is damaged when the PAB is deployed, replace the damaged crash pad and PAB together.

6. Remove the heater duct from the crash pad.
7. Remove the mounting nuts(6EA) from the crash pad. Then remove the passenger airbag.

**CAUTION**

The removed airbag module should be stored in a clean and dry place with the pad cover face up.

**INSTALLATION**

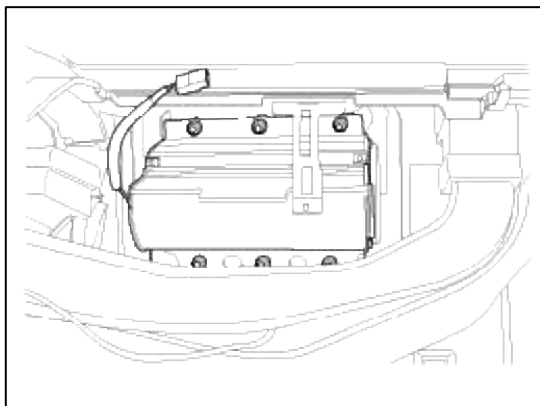
1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.



3. Place a Passenger Airbag (PAB) on the crash pad and tighten the Passenger Airbag (PAB) mounting nuts.

Tightening torque

: 0.9 ~ 1.4 kgf.m (8.8 ~ 13.7 N.m, 6.5 ~ 10.1 lb.ft)



4. Install the heater duct to the crash pad.
5. Install the crash pad. (Refer to BD group)
6. Tighten the PAB mounting bolt.

Tightening torque

: 1.9 ~ 2.7 kgf.m (18.6 ~ 26.5 N.m, 13.7 ~ 19.5 lb.ft)

7. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
8. Reinstall the glove box. (Refer to BD group)
9. Reconnect the battery negative cable.
10. After installing the Passenger Airbag (PAB), confirm proper system operation:
  - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

## **Restraint > Airbag Module > Curtain Airbag (CAB) Module > Description and Operation**

### **DESCRIPTION**

Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passenger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

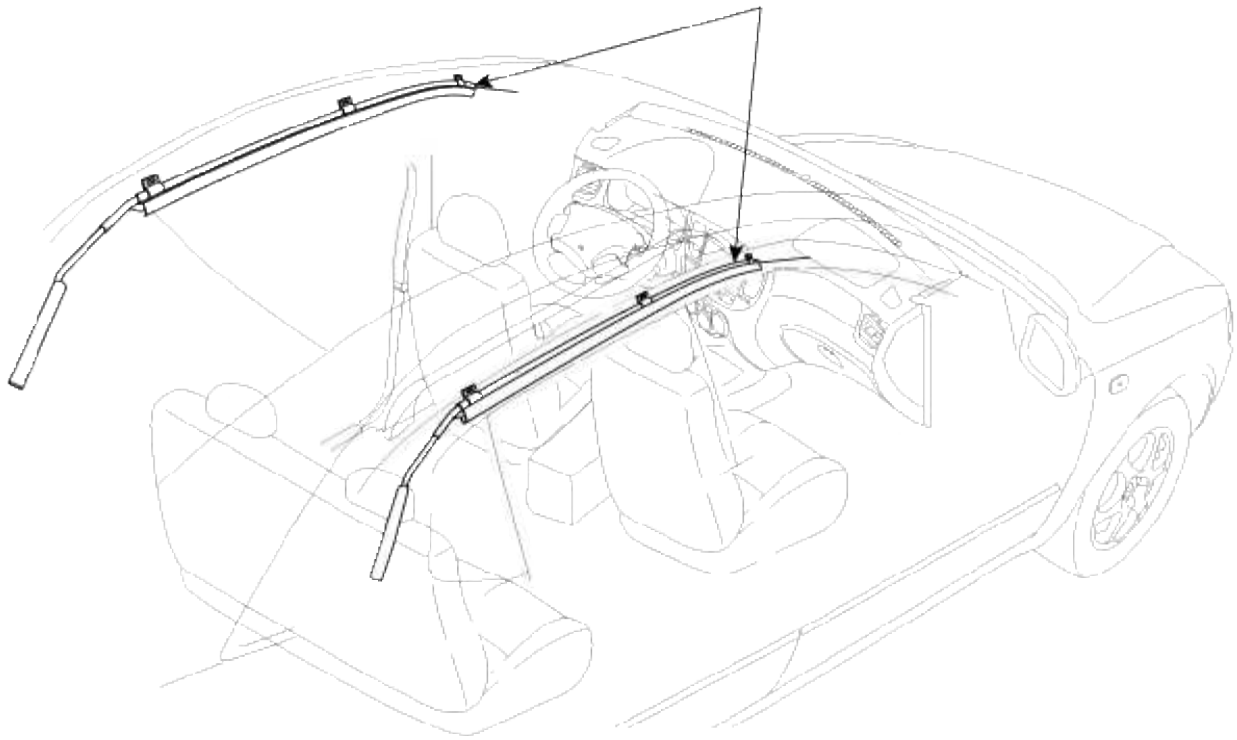
#### **CAUTION**

Never attempt to measure the circuit resistance of the airbag module even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

## **Restraint > Airbag Module > Curtain Airbag (CAB) Module > Components and Components Location**

### **COMPONENTS**

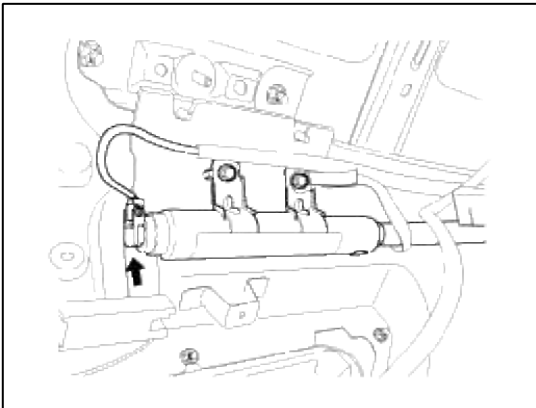
Curtain Airbag (CAB)



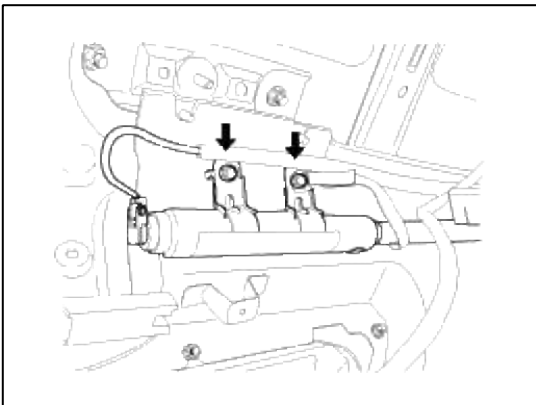
### Restraint > Airbag Module > Curtain Airbag (CAB) Module > Repair procedures

#### REMOVAL

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the following parts. (Refer to BD group)
  - A. Side trim, Roof trim
3. Disconnect the Curtain Airbag harness connector.



4. After loosening the mounting bolts(6EA) and nut (1EA) remove the curtain airbag.



## INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Tighten the CAB mounting bolts (6EA) and nut (1EA).

Tightening torque

: 0.8 ~ 1.2 kgf.m (7.8 ~ 11.8 Nm, 5.8 ~ 8.7 lb.ft)

### CAUTION

- Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.

4. Connect the CAB connector.
5. Install the following parts. (Refer to BD group)
  - A. Side trim, Roof trim
6. Reconnect the battery negative cable.
7. After installing the Curtain Airbag (CAB), confirm proper system operation:
  - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

## Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Description and Operation

### DESCRIPTION

The Seat Belt Pretensioners (BPT) are installed inside Center Pillar (LH & RH). When a vehicle crashes with a certain degree of frontal impact, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupants by retracting the seat belt webbing. This prevents the front occupants from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.

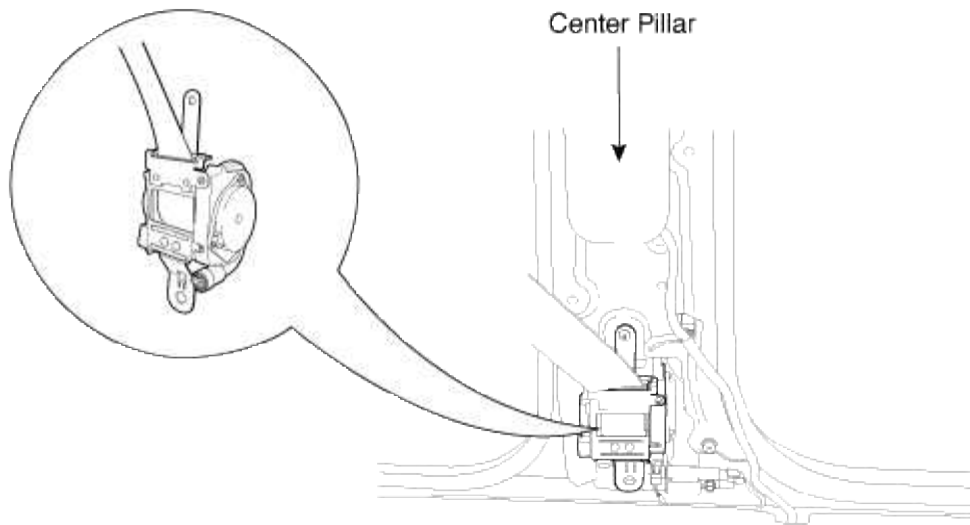
### CAUTION

Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

## Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Components and Components Location

### COMPONENTS

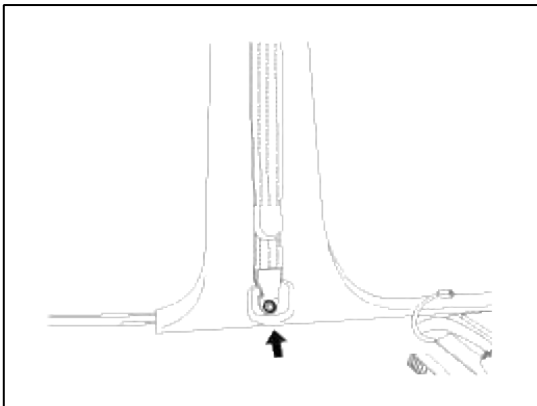
Seat Belt Retractor Pretensioner (BPT)



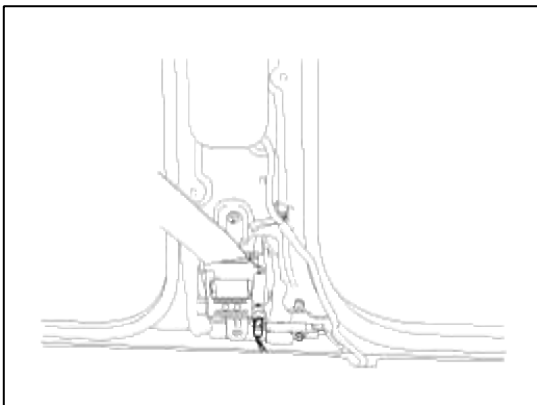
### Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Repair procedures

#### REMOVAL

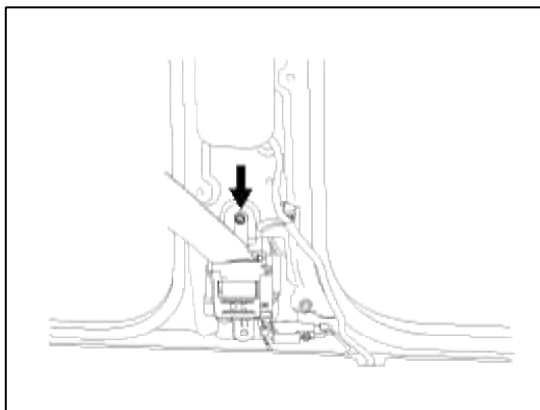
1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the lower anchor bolt.



3. Remove the following parts. (Refer to BD group)
  - A. Door scuff trim, Center pillar trim
4. Remove the upper anchor bolt.
5. Disconnect the Seat Belt Pretensioner connector.



6. Loosen the Seat Belt Pretensioner mounting screw and remove the Seat Belt Pretensioner.



## INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Install the Seat Belt Pretensioner (BPT) with a screw.
4. Connect the Seat Belt Pretensioner (BPT) connector.
5. Install the upper anchor bolt.

---

Tightening torque (Seat Belt Anchor Bolt)  
: 4.0 ~ 5.5 kgf.m (39.2 ~ 53.9 Nm, 28.9 ~ 39.8 lb.ft)

---

6. Install the center pillar trim.
7. Install the door scuff trim.
8. Install the lower anchor bolt.

---

Tightening torque  
: 4.0 ~ 5.5 kgf.m (39.2 ~ 53.9 Nm, 28.9 ~ 39.8 lb.ft)

---

9. Reconnect the battery negative cable.
10. After installing the Seat Belt Pretensioner (BPT), confirm proper system operation:
  - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

## Restraint > Troubleshooting > B1101 Battery Voltage High

### DTC Description

The SRSCM sets above DTC(s) if it detects that the battery voltage of restraint system is too high or too low. When the voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

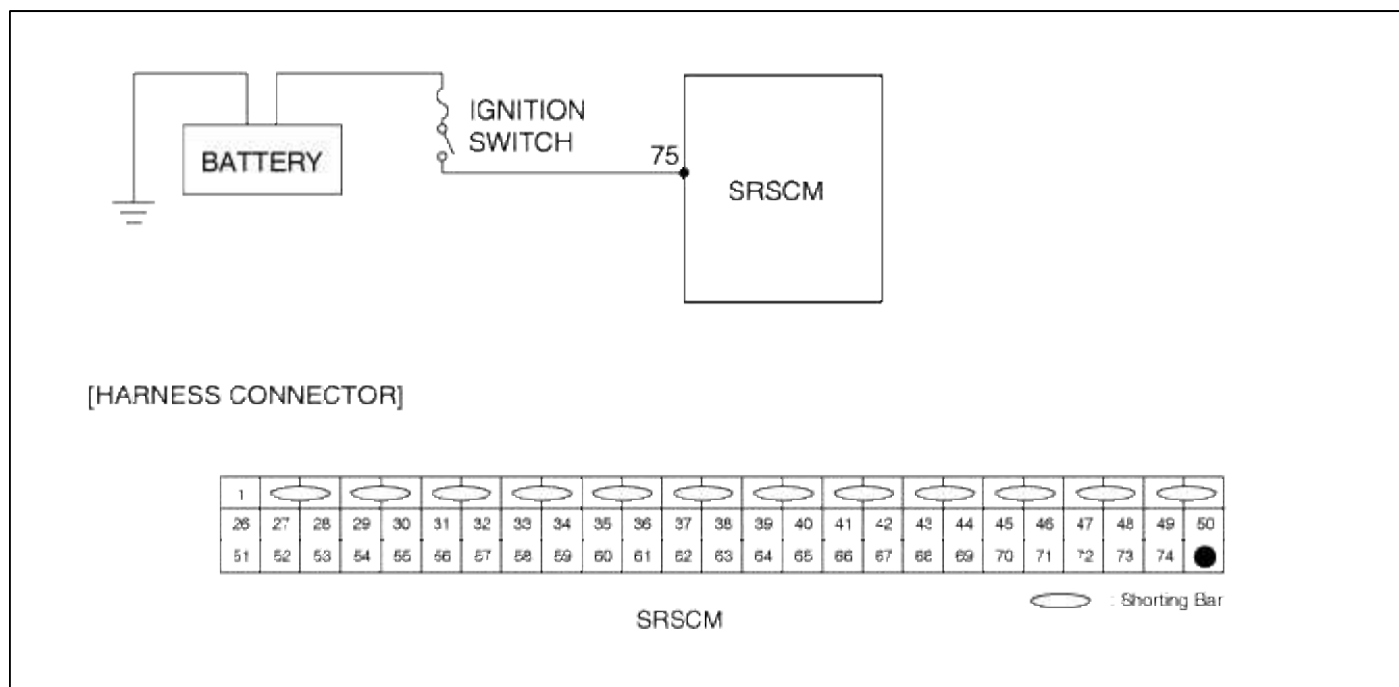
### DTC Detecting Condition

DTC	Condition	Probable cause
B1101	Battery Voltage > 16.0 V for 4 seconds after IG ON	<ul style="list-style-type: none"> <li>• Battery</li> <li>• Generator</li> <li>• Wiring Harness</li> <li>• SRSCM</li> </ul>
B1102	Battery Voltage < 9.0 V for 4 seconds after IG ON	

## Specification

Voltage : 9.0 ~ 16.0 V

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

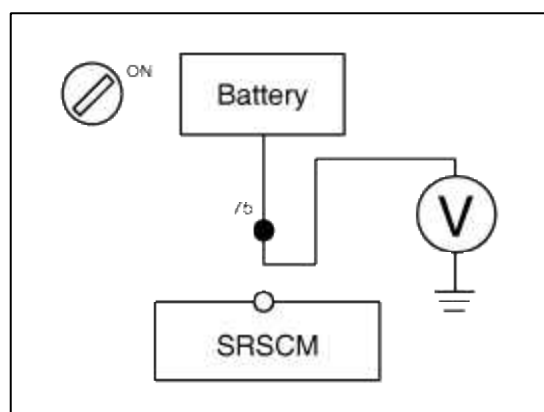
### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### 2. CHECK SOURCE VOLTAGE

- (1) Turn the ignition switch to ON.
- (2) Measure voltage between the terminal 75 of SRSCM harness connector and chassis ground.

Specification (voltage) : 9.0 ~ 16.0 V



(3) Is the measured voltage within specification?

**NO**

Check the battery.

**YES**

Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

### 3. CHECK THE BATTERY

(1) Check the battery.

- Refer to "EE" group in this SERVICE MANUAL.

Is the battery normal?

**YES**

Check the generator.

**NO**

Repair or replace the battery.(Refer to "EE" group in this SERVICE MANUAL)

### 4. CHECK GENERATOR

(1) Check the generator.

- Refer to "EE" group in this SERVICE MANUAL.

Is the generator normal?

**YES**

Check wiring harness.

**NO**

Repair or replace the generator.(Refer to "EE" group in this SERVICE MANUAL)

### 5. CHECK WIRING HARNESS

(1) Check the wiring harness between the battery and SRSCM.

Is the wiring harness normal?

**YES**

Check the DTC again.

**NO**

Repair or replace the wiring harness.

### 6. CHECK THE DTC AGAIN

(1) Turn the ignition switch to LOCK and wait for at least 30 seconds.

#### CAUTION

Check again that the battery negative cable is disconnected from the battery.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the battery negative cable to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC?

**YES**

Perform the troubleshooting procedures associated with those codes.

**NO**

Problem is intermittent or was repaired and SRSCM memory was not cleared.

## Restraint > Troubleshooting > B1102 Battery Voltage Low

### DTC Description

The SRSCM sets above DTC(s) if it detects that the battery voltage of restraint system is too high or too low. When the voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

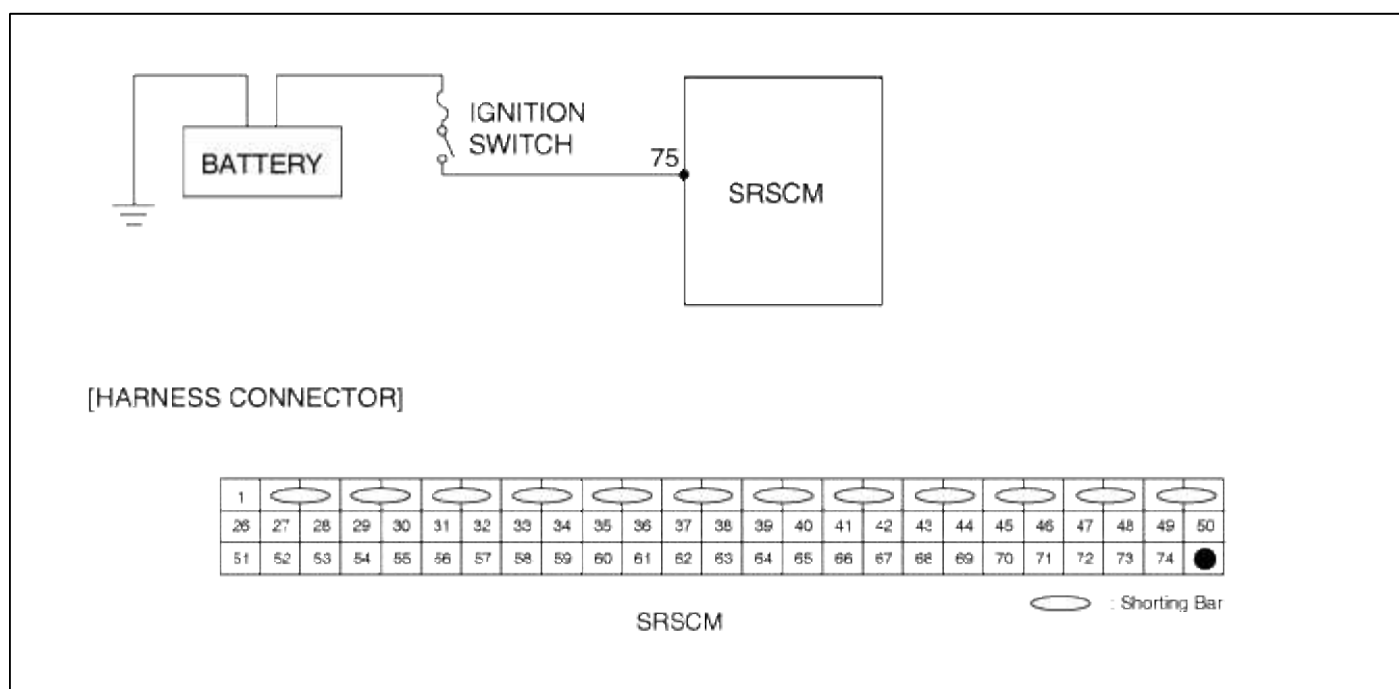
### DTC Detecting Condition

DTC	Condition	Probable cause
B1101	Battery Voltage > 16.0 V for 4 seconds after IG ON	<ul style="list-style-type: none"> <li>• Battery</li> <li>• Generator</li> <li>• Wiring Harness</li> <li>• SRSCM</li> </ul>
B1102	Battery Voltage < 9.0 V for 4 seconds after IG ON	

### Specification

Voltage : 9.0 ~ 16.0 V

### Schematic Diagram



### Terminal & Connector Inspection



Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

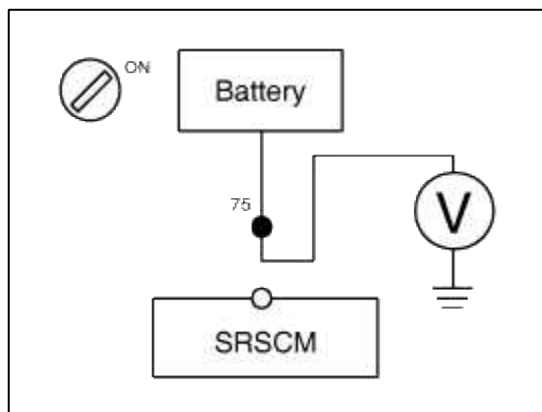
### 2. CHECK SOURCE VOLTAGE

- (1) Turn the ignition switch to ON.
- (2) Measure voltage between the terminal 75 of SRSCM harness connector and chassis ground.

---

Specification (voltage) : 9.0 ~ 16.0 V

---



- (3) Is the measured voltage within specification?

**NO**

Check the battery.

**YES**

Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

### 3. CHECK THE BATTERY

- (1) Check the battery.

- Refer to "EE" group in this SERVICE MANUAL.

Is the battery normal?

**YES**

Check the generator.

**NO**

Repair or replace the battery.(Refer to "EE" group in this SERVICE MANUAL)

### 4. CHECK GENERATOR

- (1) Check the generator.

- Refer to "EE" group in this SERVICE MANUAL.

Is the generator normal?

**YES**

Check wiring harness.

**NO**

Repair or replace the generator.(Refer to "EE" group in this SERVICE MANUAL)

## 5. CHECK WIRING HARNESS

- (1) Check the wiring harness between the battery and SRSCM.

Is the wiring harness normal?

**YES**

Check the DTC again.

**NO**

Repair or replace the wiring harness.

## 6. CHECK THE DTC AGAIN

- (1) Turn the ignition switch to LOCK and wait for at least 30 seconds.

### CAUTION

Check again that the battery negative cable is disconnected from the battery.

- (2) Install the DAB module and connect the DAB connector.  
 (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.  
 (4) Connect the SRSCM connector.  
 (5) Connect the battery negative cable to the battery.  
 (6) Connect a Hi-Scan(Pro) to the data link connector.  
 (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC?

**YES**

Perform the troubleshooting procedures associated with those codes.

**NO**

Problem is intermittent or was repaired and SRSCM memory was not cleared.

## Restraint > Troubleshooting > B1338 FIS(Front Impact Sensor)-Center Defect

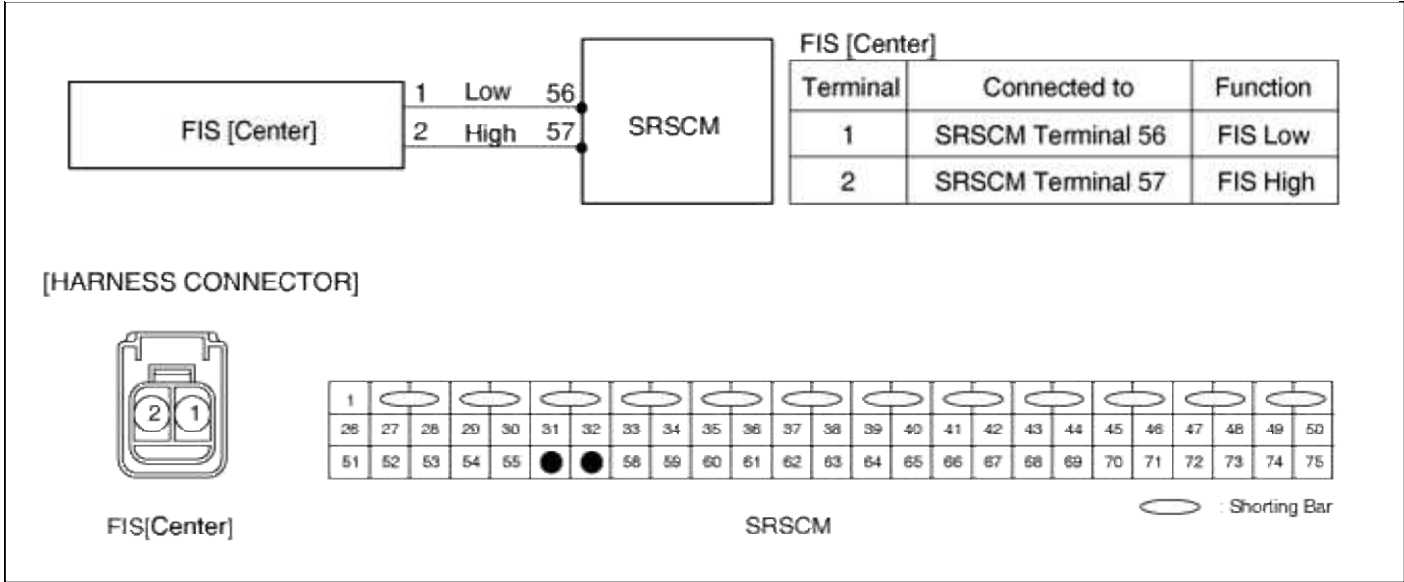
### DTC Description

The detecting system for front crash consists of the SRSCM and one Front Impact Sensor (FIS). The SRSCM sets above DTC(s) if it detects that FIS is defective or there is communication error between the FIS and the SRSCM.

### DTC Detecting Condition

DTC	Condition	Probable cause
B1338 B1339	<ul style="list-style-type: none"> <li>• Open between FIS and SRSCM</li> <li>• Front Impact Sensor(FIS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• Front Impact Sensor(FIS)</li> <li>• SRSCM</li> </ul>

### Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

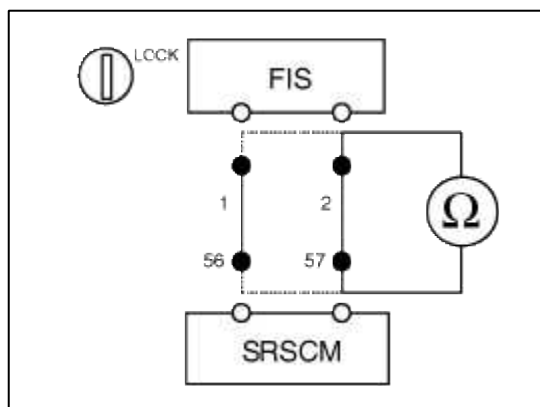
## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK FIS CIRCUIT

- (1) Measure resistance between the terminal 2 of FIS harness connector and the terminal 57 of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of FIS harness connector and the terminal 56 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Check Front Impact Sensor.

NO

Repair or replace the wiring harness between the FIS and the SRSCM.

### 3. CHECK FRONT IMPACT SENSOR

- (1) Replace the front impact sensor(FIS) with a new one.
  - Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to FIS?

**YES**

Go to next step.

**NO**

Replace the Front Impact Sensor(FIS).

### 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B1339 FIS(Front Impact Sensor)-Center Communication error

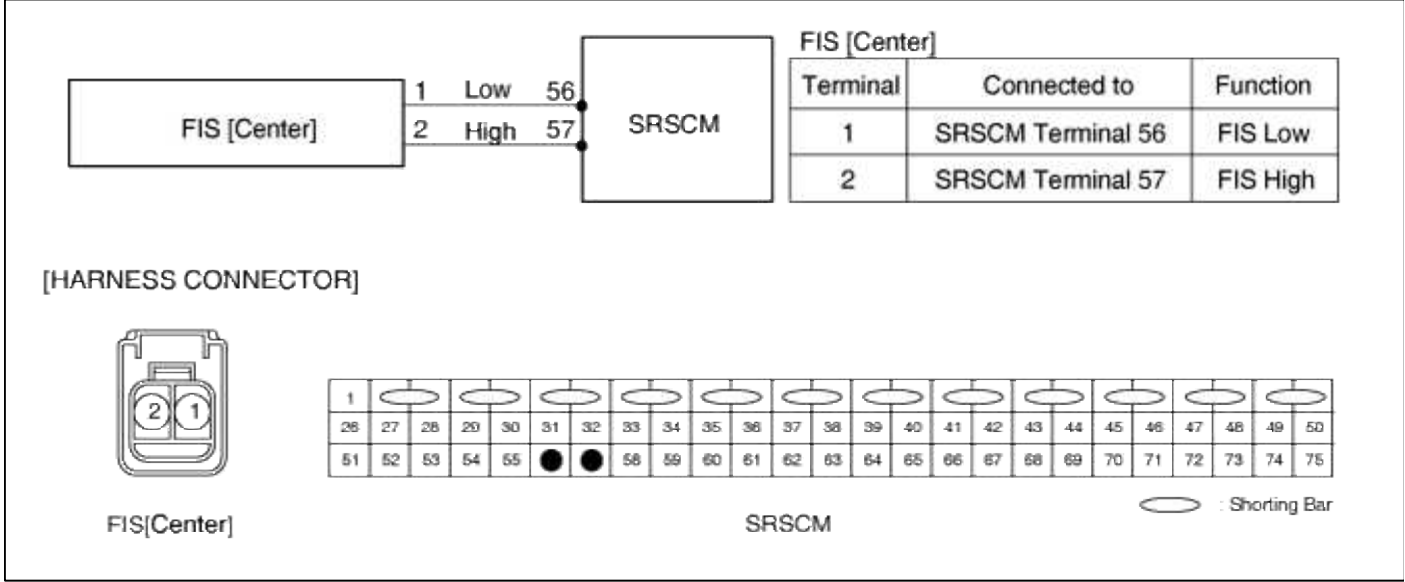
##### DTC Description

The detecting system for front crash consists of the SRSCM and one Front Impact Sensor (FIS). The SRSCM sets above DTC(s) if it detects that FIS is defective or there is communication error between the FIS and the SRSCM.

##### DTC Detecting Condition

DTC	Condition	Probable cause
B1338 B1339	<ul style="list-style-type: none"> <li>• Open between FIS and SRSCM</li> <li>• Front Impact Sensor(FIS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• Front Impact Sensor(FIS)</li> <li>• SRSCM</li> </ul>

##### Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

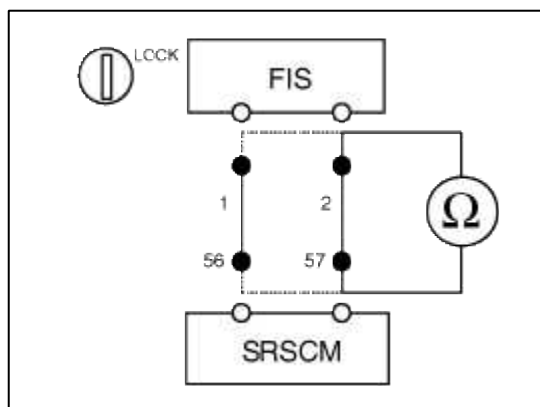
## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK FIS CIRCUIT

- (1) Measure resistance between the terminal 2 of FIS harness connector and the terminal 57 of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of FIS harness connector and the terminal 56 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Check Front Impact Sensor.

NO

Repair or replace the wiring harness between the FIS and the SRSCM.

### 3. CHECK FRONT IMPACT SENSOR

- (1) Replace the front impact sensor(FIS) with a new one.
  - Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to FIS?

**YES**

Go to next step.

**NO**

Replace the Front Impact Sensor(FIS).

### 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B1346 Driver Airbag Resistance too High (1st stage)

##### DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

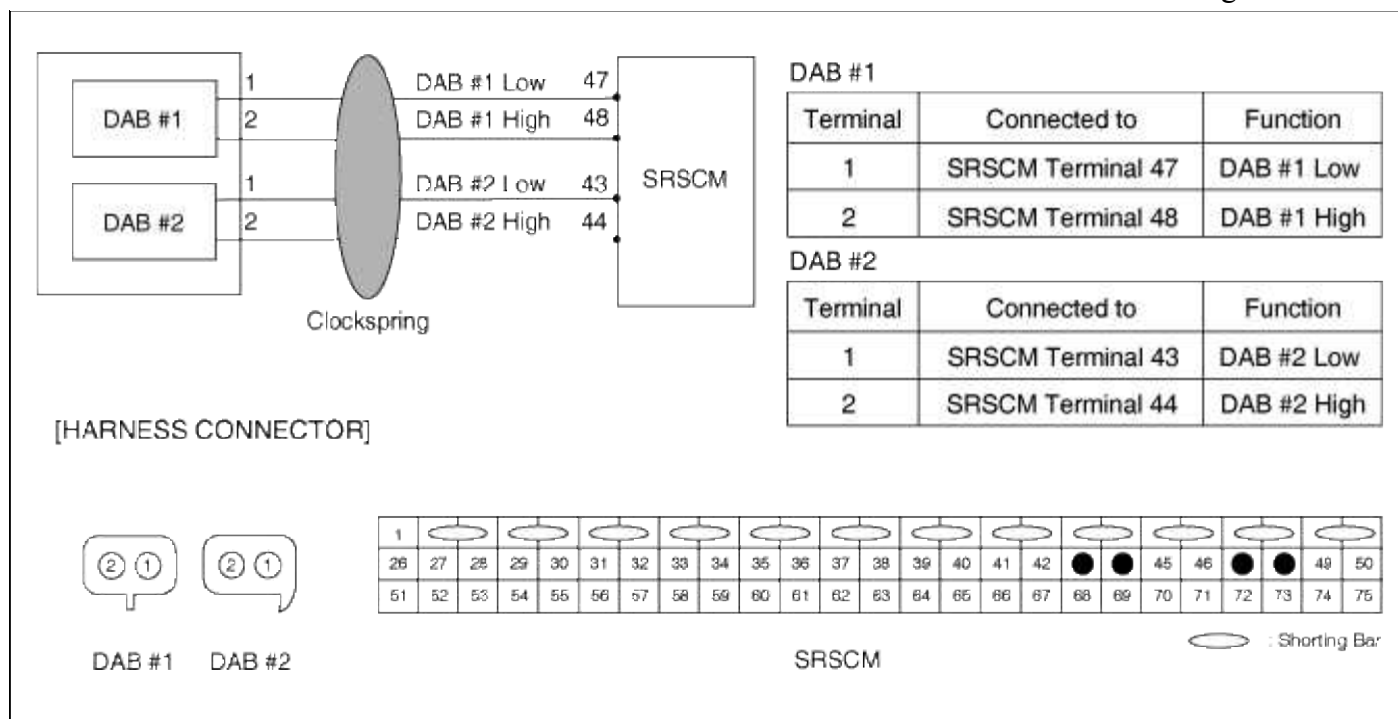
##### DTC Detecting Condition

DTC	Condition	Probable cause
B1346 B1347	<ul style="list-style-type: none"> <li>• Too high or low resistance between DAB high(+) and DAB low (-)</li> <li>• Driver Airbag (DAB) Malfunction</li> <li>• Clockspring Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short circuit on wiring harness</li> <li>• Driver Airbag (DAB) squib</li> <li>• Clockspring</li> <li>• SRSCM</li> </ul>

##### Specification

DAB resistance : 1.4 ~ 6.0  $\Omega$

##### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

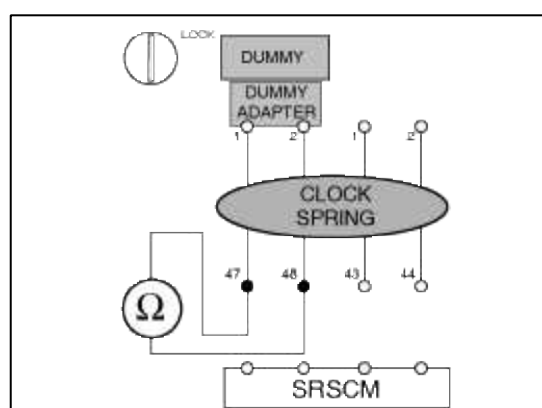
#### 2. CHECK DAB RESISTANCE

#### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 47 and 48 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 6.0  $\Omega$



(3) Is the measured resistance within specification?

**NO**

Check open circuit.

**YES**

Replace the Driver Airbag(DAB) module.

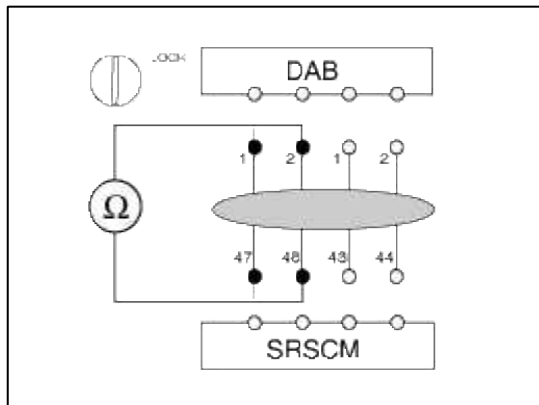
### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 1 of DAB harness connector and the terminal 48 of SRSCM harness connector.
- (2) Measure resistance between the terminal 2 of DAB harness connector and the terminal 47 of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

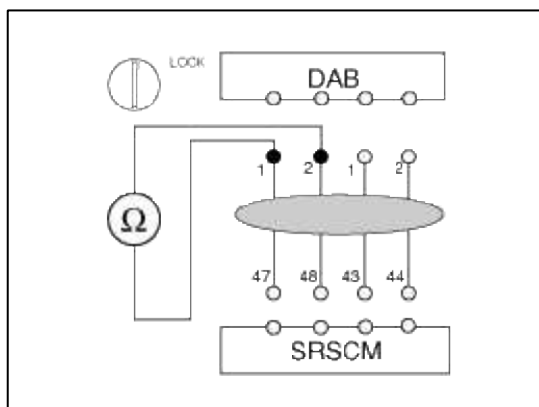
### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of DAB harness connector.

---

Specification (resistance) :  $\infty \Omega$

---





(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1347 Driver Airbag Resistance too Low (1st stage)

#### DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

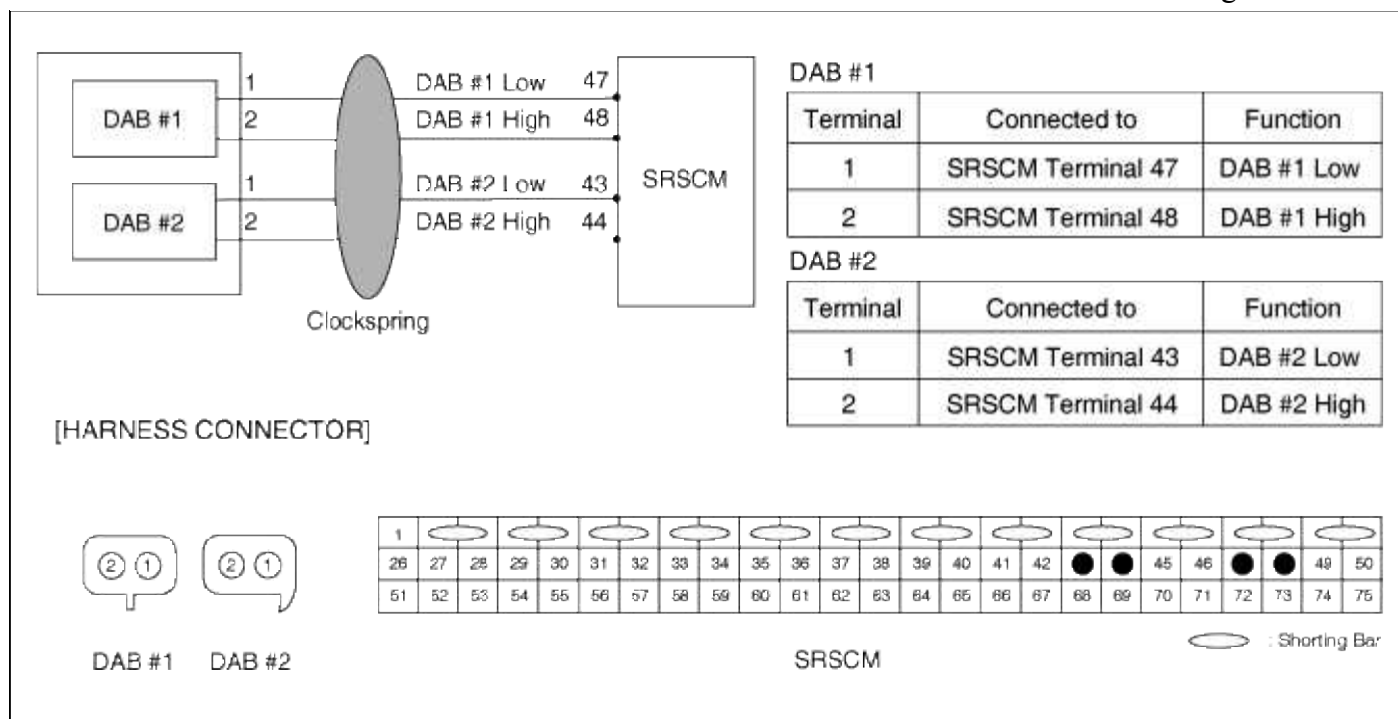
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1346 B1347	<ul style="list-style-type: none"> <li>Too high or low resistance between DAB high(+) and DAB low (-)</li> <li>Driver Airbag (DAB) Malfunction</li> <li>Clockspring Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Driver Airbag (DAB) squib</li> <li>Clockspring</li> <li>SRSCM</li> </ul>

#### Specification

DAB resistance : 1.4 ~ 6.0  $\Omega$

#### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

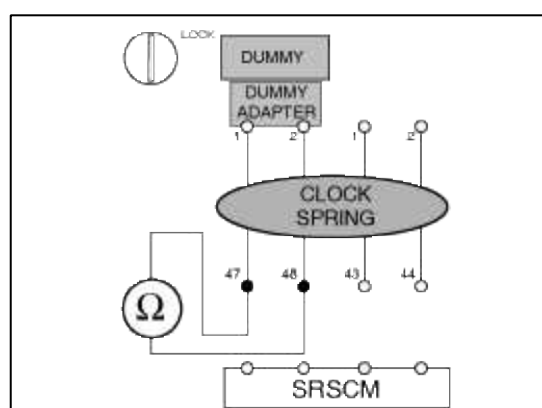
#### 2. CHECK DAB RESISTANCE

#### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 47 and 48 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 6.0  $\Omega$



(3) Is the measured resistance within specification?

**NO**

Check open circuit.

**YES**

Replace the Driver Airbag(DAB) module.

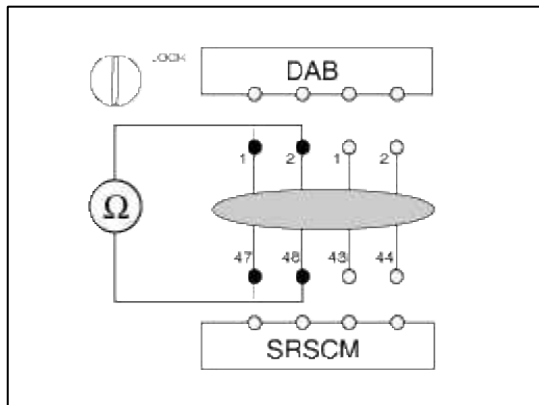
### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 1 of DAB harness connector and the terminal 48 of SRSCM harness connector.
- (2) Measure resistance between the terminal 2 of DAB harness connector and the terminal 47 of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

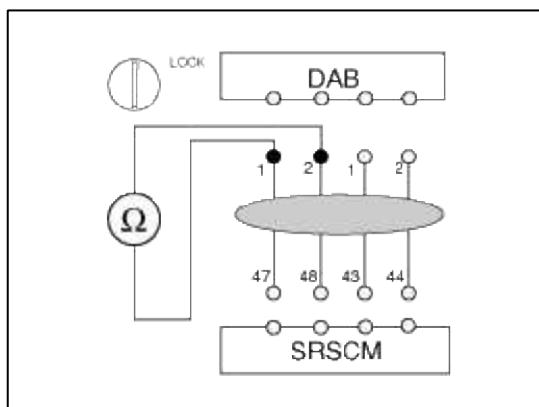
### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of DAB harness connector.

---

Specification (resistance) :  $\infty \Omega$

---



(2) Is the measured resistance within specification?

**YES**

Go to next step.

NO

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

## 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Restraint > Troubleshooting > B1348 Driver Airbag resistance circuit short to Ground (1st stage)

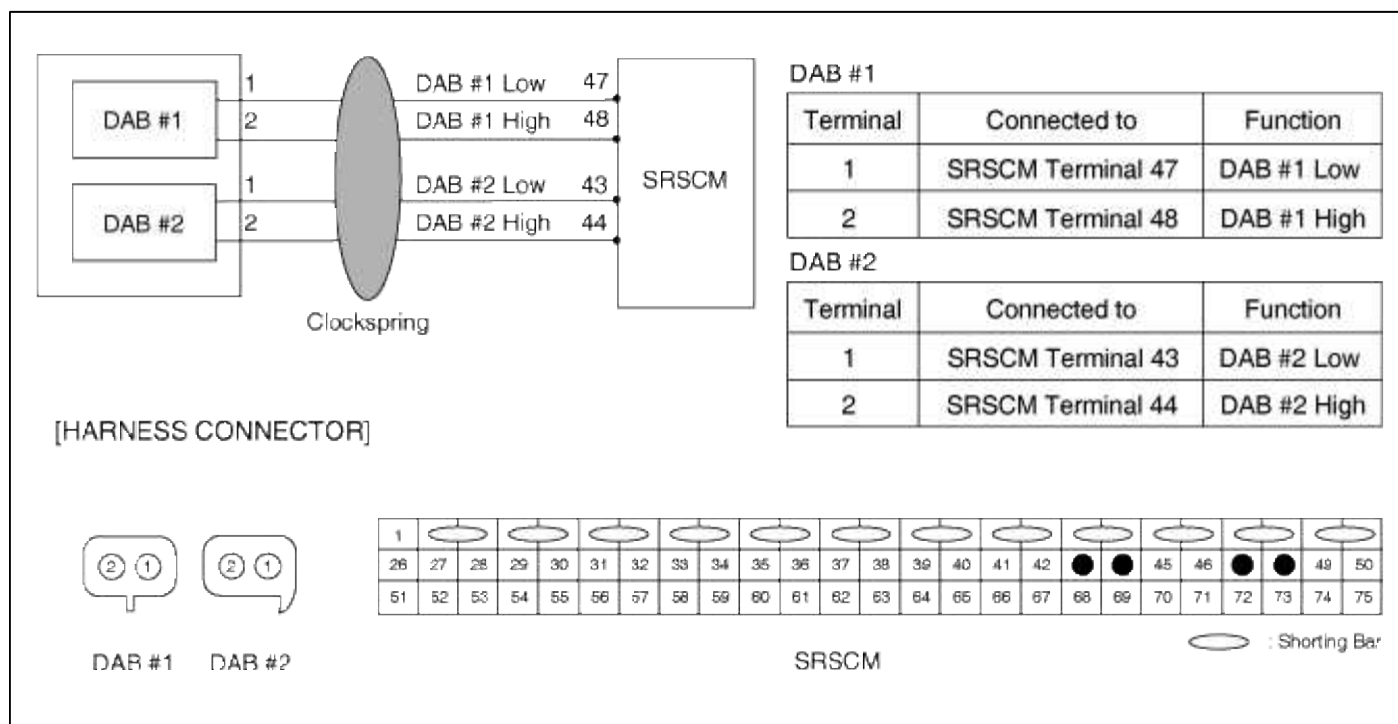
### DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

### DTC Detecting Condition

DTC	Condition	Probable cause
B1348 B1483	<ul style="list-style-type: none"> <li>• Short to ground between DAB and clockspring</li> <li>• Short to ground between clockspring and SRSCM</li> <li>• Driver Airbag (DAB) Malfunction</li> <li>• Clockspring Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to ground circuit on wiring harness</li> <li>• Driver Airbag (DAB) squib</li> <li>• Clockspring</li> <li>• SRSCM</li> </ul>

### Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

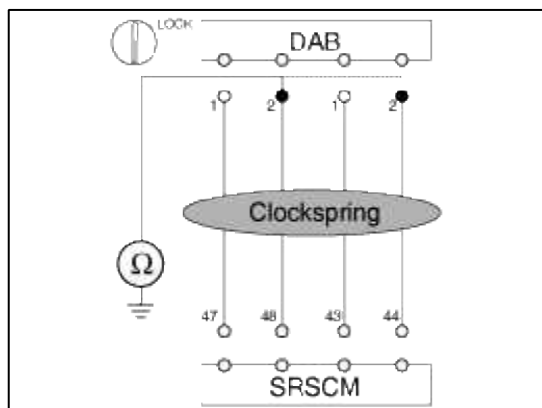
## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 2 of DAB harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the DAB Module.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

## 3. CHECK THE DAB MODULE

- (1) Replace the Driver Airbag(DAB) with a new one.  
 • Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.  
 Does Hi-Scan (Pro) indicate any DTC related to DAB?

**YES**

Check the clockspring.

**NO**

Replace the Driver Airbag(DAB).

## 4. CHECK THE CLOCKSPRING

- (1) Check the clockspring.  
 Is the clockspring normal?

**YES**

Go to next step.

**NO**

Replace the clockspring.

## 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1349 Driver Airbag resistance circuit short to Battery (1st stage)

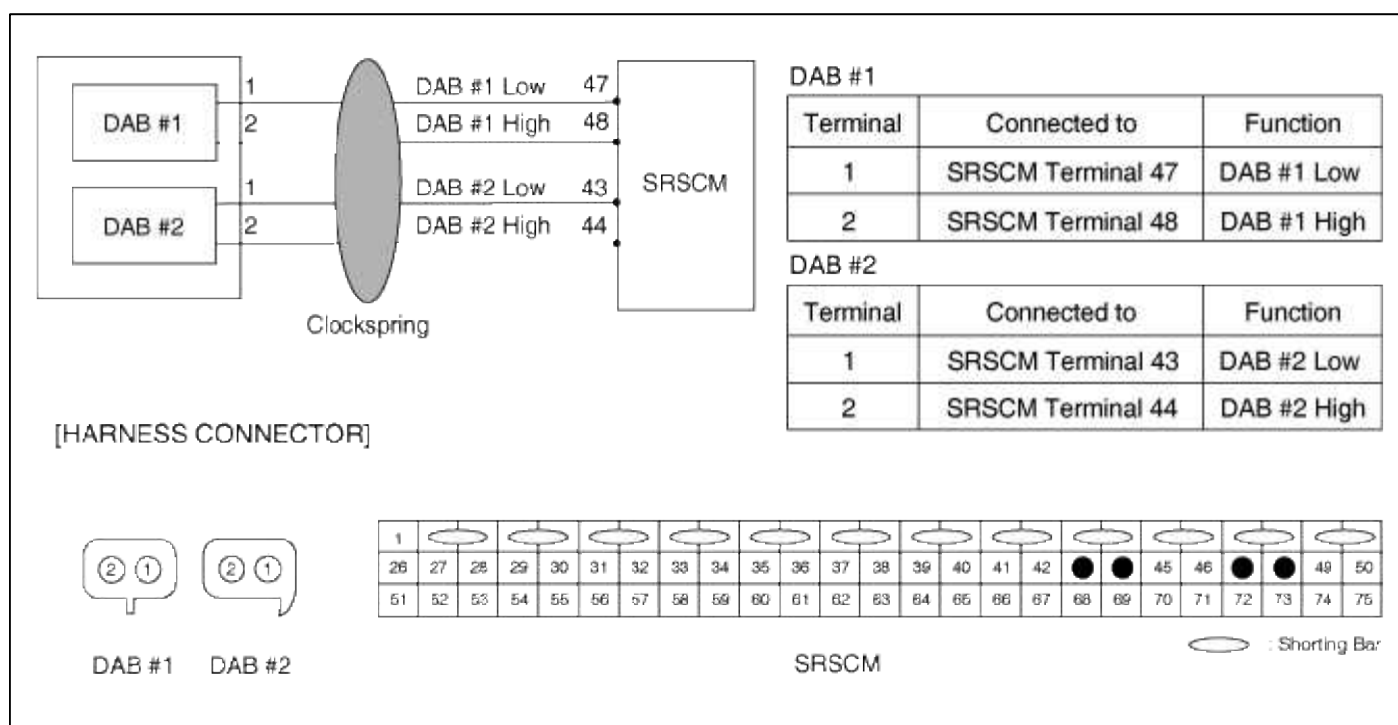
#### DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1349 B1484	<ul style="list-style-type: none"> <li>Short to battery line between DAB and clockspring</li> <li>Short to battery line between clockspring and SRSCM</li> <li>Driver Airbag (DAB) Malfunction</li> <li>Clockspring Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Short to battery line on wiring harness</li> <li>Driver Airbag (DAB) squib</li> <li>Clockspring</li> <li>SRSCM</li> </ul>

#### Schematic Diagram



#### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Inspection Procedure

##### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

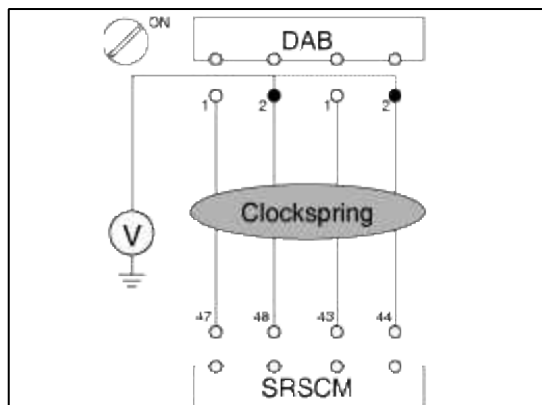
## 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2 of DAB harness connector and chassis ground.

---

Specification (voltage) : Approximately 0 V

---



- (4) Is the measured voltage within specification?

**YES**

Check the DAB module.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

## 3. CHECK THE DAB MODULE

- (1) Replace the Driver Airbag(DAB) with a new one.
  - Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to DAB?

**YES**

Check the clockspring.

**NO**

Replace the Driver Airbag(DAB).

## 4. CHECK THE CLOCKSPRING

- (1) Check the clockspring.
- Is the clockspring normal?

**YES**

Go to next step.

**NO**

Replace the clockspring.

## 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

**Restraint > Troubleshooting > B1352 Passenger Airbag Resistance too High (1st Stage)**

## DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

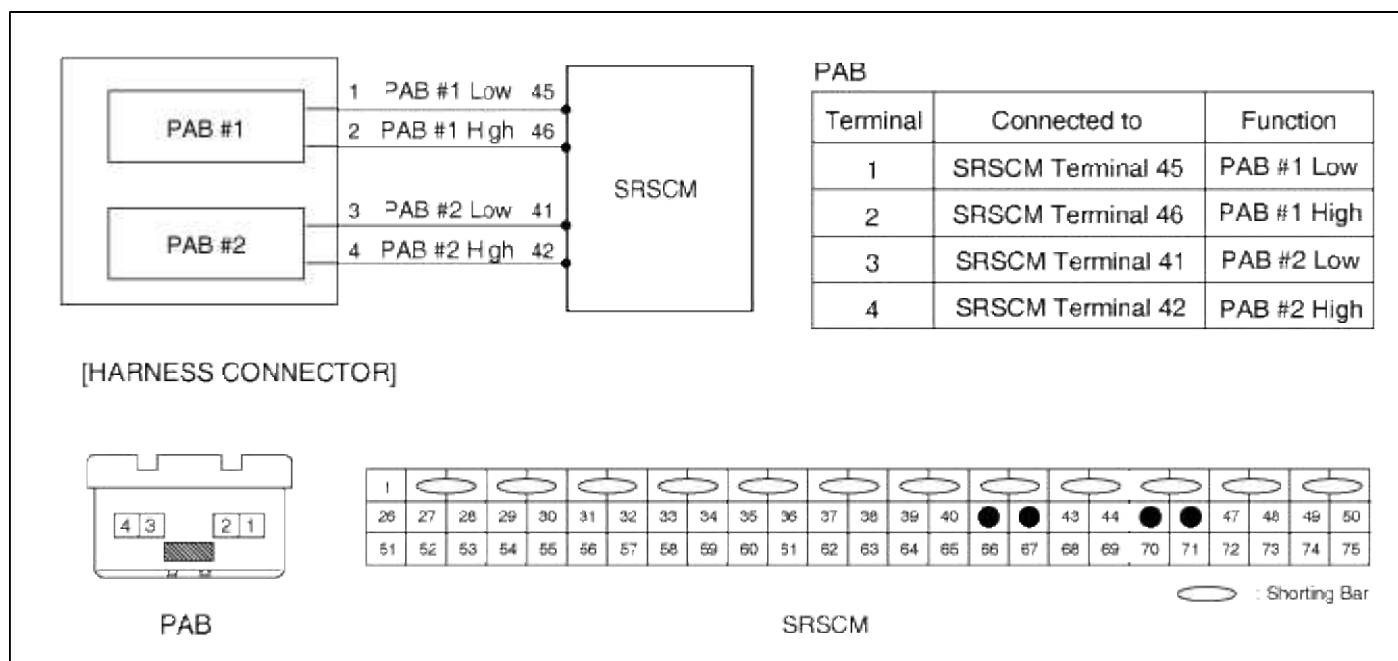
## DTC Detecting Condition

DTC	Condition	Probable cause
B1352 B1353	<ul style="list-style-type: none"> <li>Too high or low resistance between PAB high(+) and PAB low (-)</li> <li>Passenger Airbag (PAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Passenger Airbag (PAB) squib</li> <li>SRSCM</li> </ul>

## Specification

PAB resistance : 1.4 ~ 6.0  $\Omega$

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure



## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

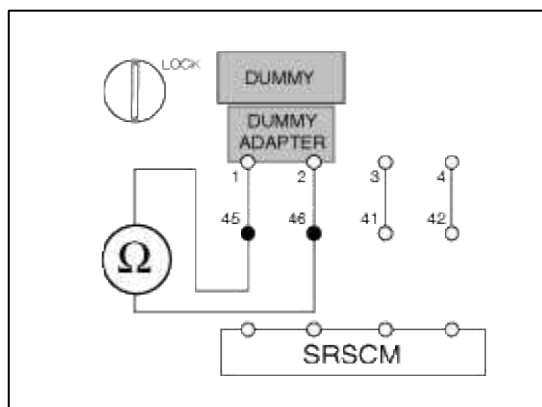
## 2. CHECK PAB RESISTANCE

### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 45 and 46 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 4.6  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Passenger Airbag(PAB) module.

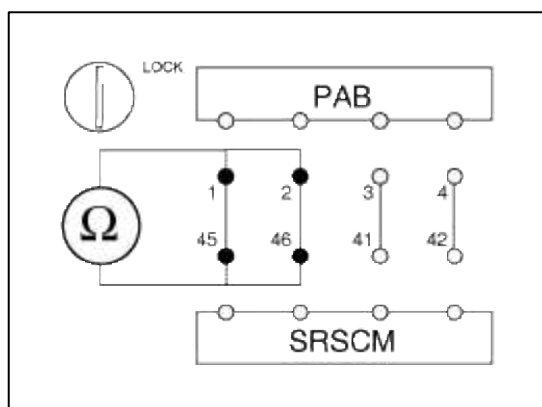
**NO**

Check open circuit.

## 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of PAB harness connector and the terminal 46 of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of PAB harness connector and the terminal 45 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

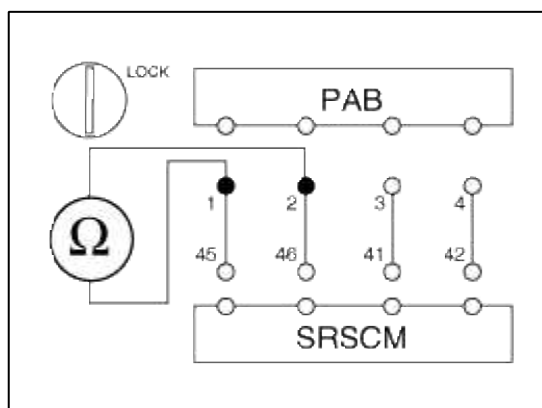
**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

#### 4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of PAB harness connector.

Specification (resistance) : infinite



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1353 Passenger Airbag Resistance too Low (1st stage)

#### DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

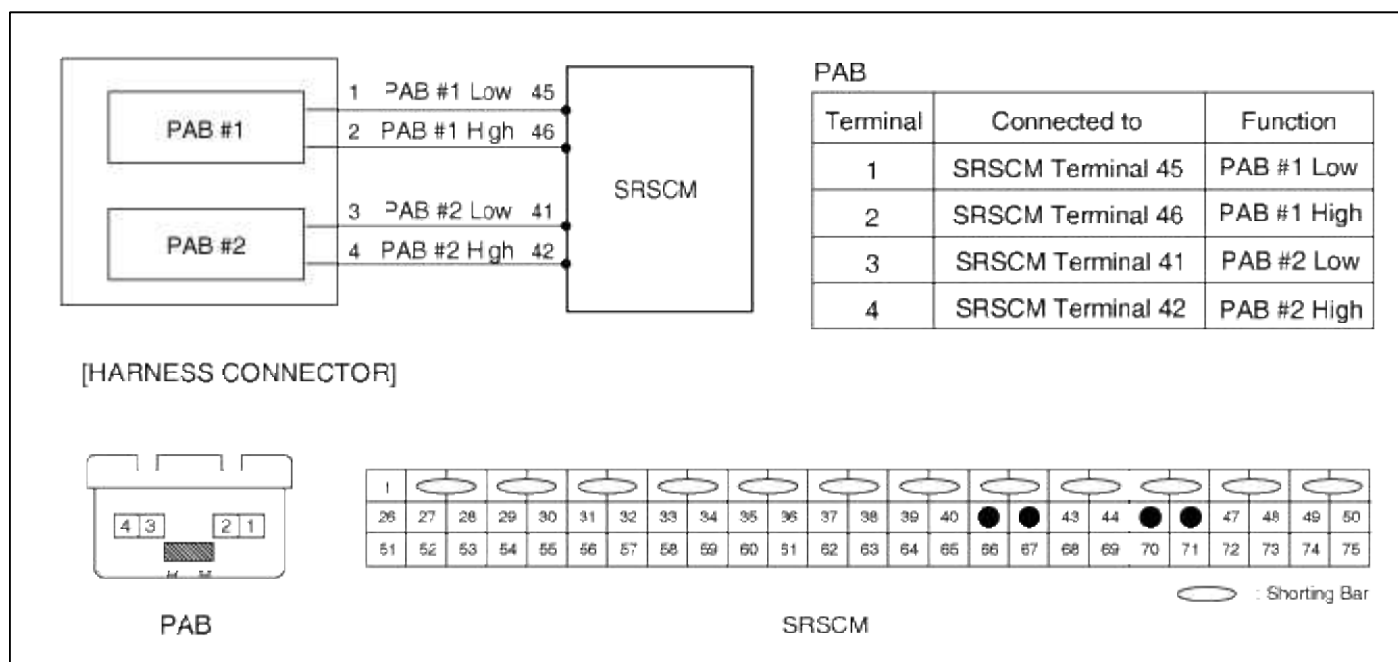
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1352 B1353	<ul style="list-style-type: none"> <li>Too high or low resistance between PAB high(+) and PAB low (-)</li> <li>Passenger Airbag (PAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Passenger Airbag (PAB) squib</li> <li>SRSCM</li> </ul>

#### Specification

PAB resistance : 1.4 ~ 6.0 Ω

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK PAB RESISTANCE

**CAUTION**

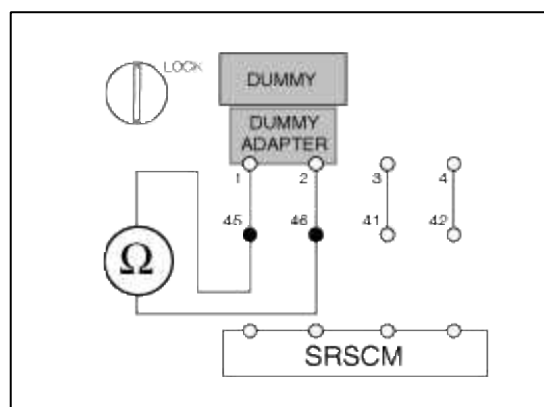
Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

(1) Connect the Dummy and the Dummy Adapter on PAB harness connector.

- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 45 and 46 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 4.6  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Replace the Passenger Airbag(PAB) module.

**NO**

Check open circuit.

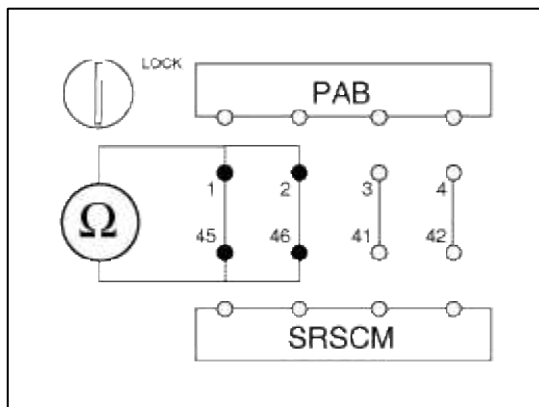
### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of PAB harness connector and the terminal 46 of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of PAB harness connector and the terminal 45 of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

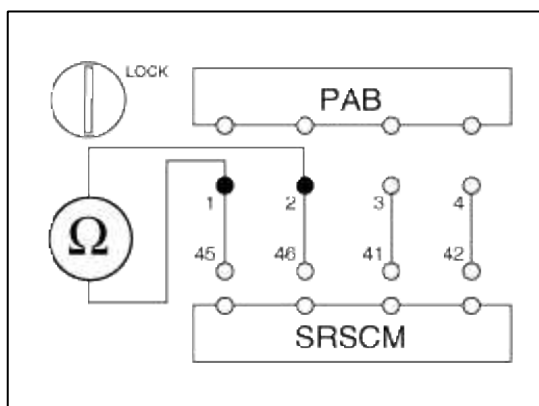
### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of PAB harness connector.

---

Specification (resistance) : infinite

---



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

## 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1354 Passenger Airbag Resistance Circuit Short to Ground (1st Stage)

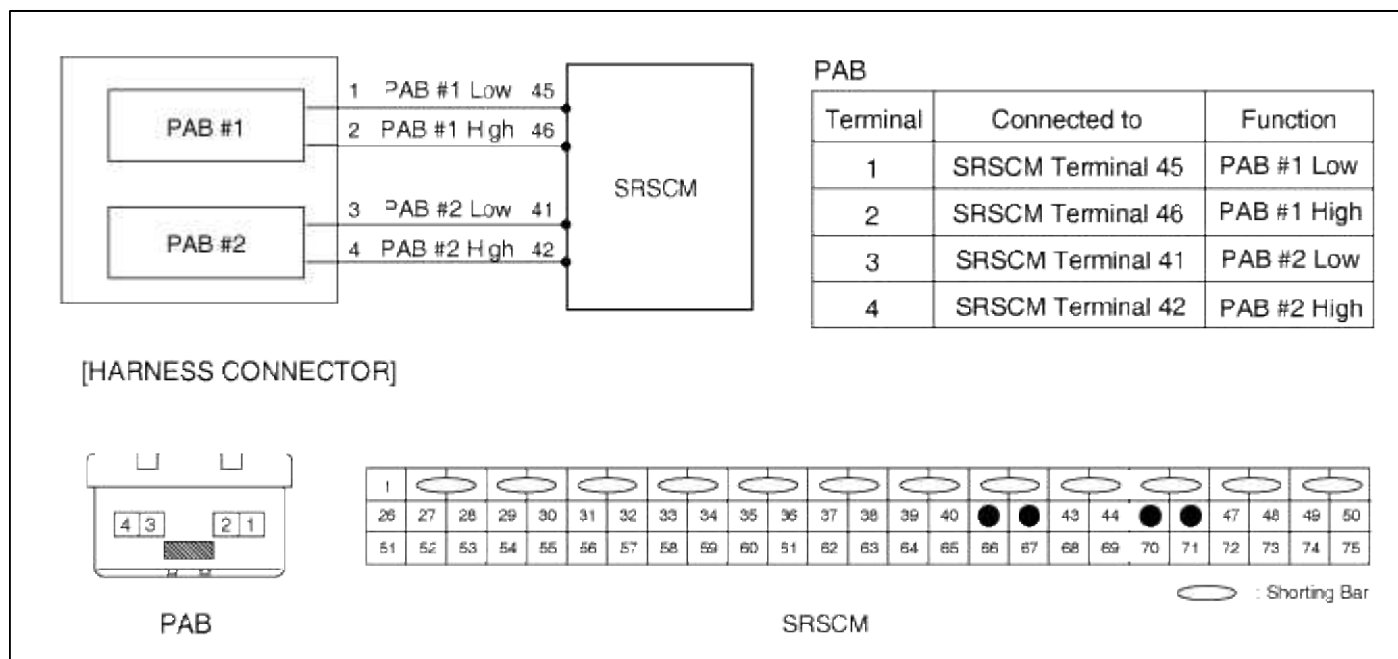
#### DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1354 B1487	<ul style="list-style-type: none"> <li>• Short to ground between PAB module and SRSCM</li> <li>• Passenger Airbag (PAB) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to ground on wiring harness</li> <li>• Passenger Airbag (PAB) squib</li> <li>• SRSCM</li> </ul>

#### Schematic Diagram



#### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Inspection Procedure

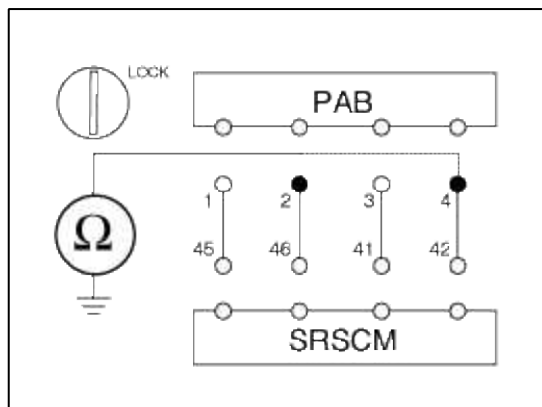
## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 2(4) of PAB harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the PAB Module.

**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

## 3. CHECK THE PAB MODULE

- (1) Replace the Passenger Airbag (PAB) with a new one.

- Refer to "Passenger Airbag (PAB)" section in this SERVICE MANUAL.

- (2) Install the DAB module and connect the DAB connector.

- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.

- (4) Connect the SRSCM connector.

- (5) Connect the battery negative cable to the battery.

- (6) Connect a Hi-Scan(Pro) to the data link connector.

- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to PAB?

**YES**

Go to next step.

**NO**

Replace PAB module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1355 Passenger Airbag Resistance Circuit Short to Battery (1st Stage)

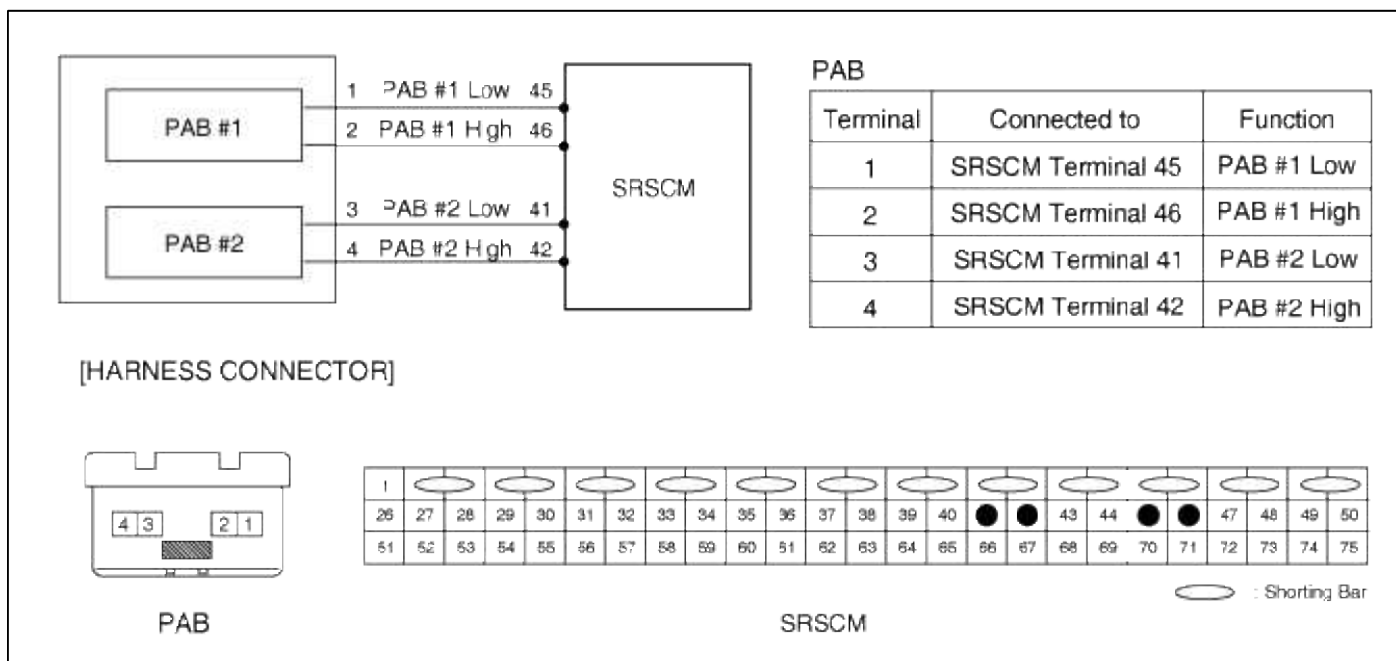
#### DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1355 B1488	<ul style="list-style-type: none"> <li>Short to battery line between PAB and SRSCM</li> <li>Passenger Airbag (PAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Short to battery line circuit on wiring harness</li> <li>Passenger Airbag (PAB) squib</li> <li>SRSCM</li> </ul>

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

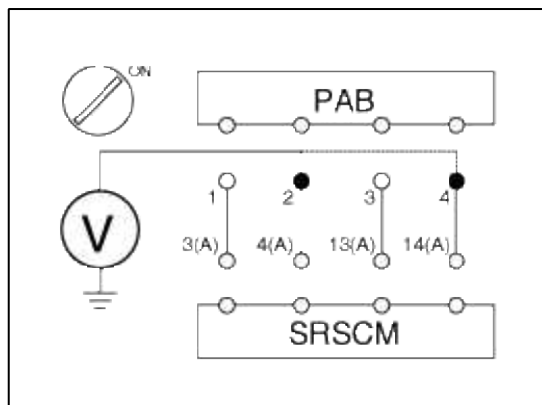
## 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2(4) of PAB harness connector and chassis ground.

---

Specification (voltage) : Approximately 0 V

---



- (4) Is the measured voltage within specification?

**YES**

Check the PAB Module.

**NO**

Repair the short to battery line circuit on wiring harness between the PAB and the SRSCM.

## 3. CHECK THE PAB MODULE

- (1) Replace the Passenger Airbag(PAB) with a new one.
  - Refer to "Passenger Airbag(PAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to PAB?

**YES**

Go to next step.

**NO**

Replace PAB module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1361 Pretensioner Front-Driver Resistance too High

#### DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

#### DTC Detecting Condition

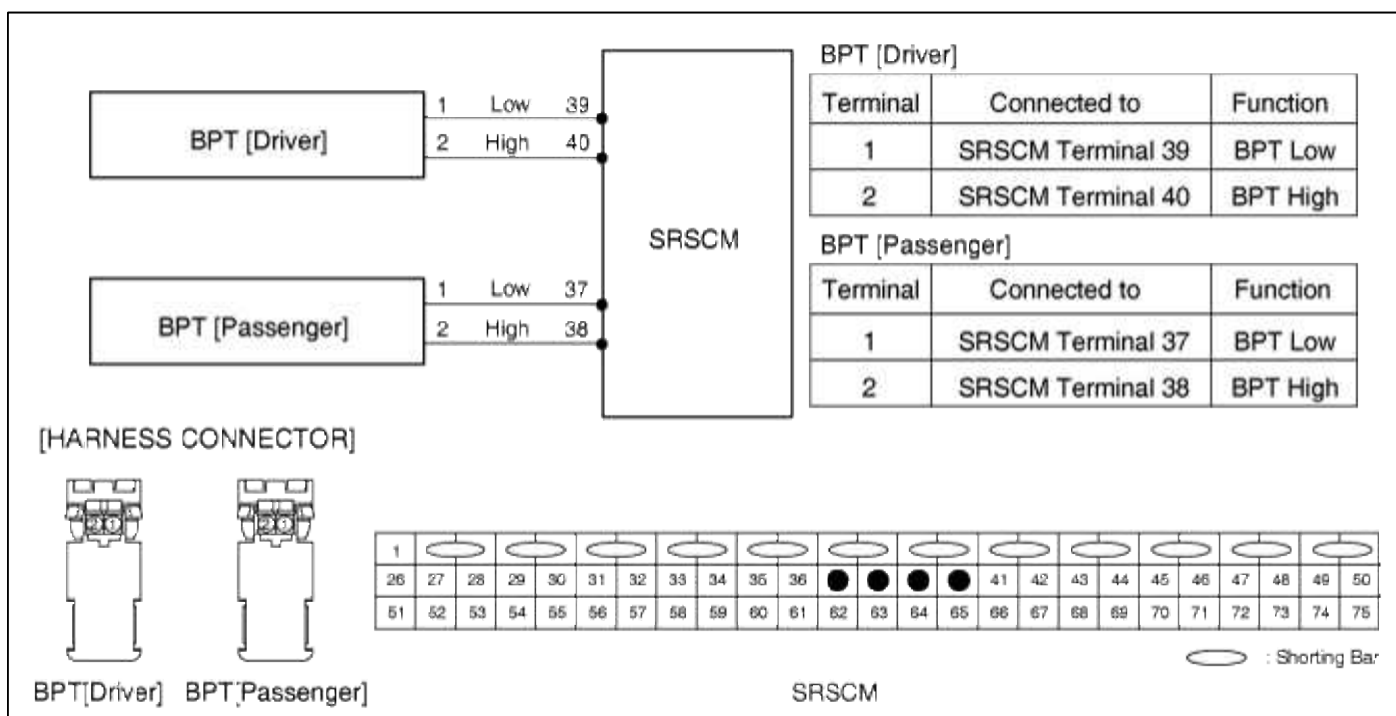


DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	<ul style="list-style-type: none"> <li>Too high or low resistance between BPT high(+) and BPT low (-)</li> <li>Seat Belt Pretensioner (BPT) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Seat Belt Pretensioner (BPT) squib</li> <li>SRSCM</li> </ul>

## Specification

BPT resistance : 1.4 ~ 4.5  $\Omega$

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

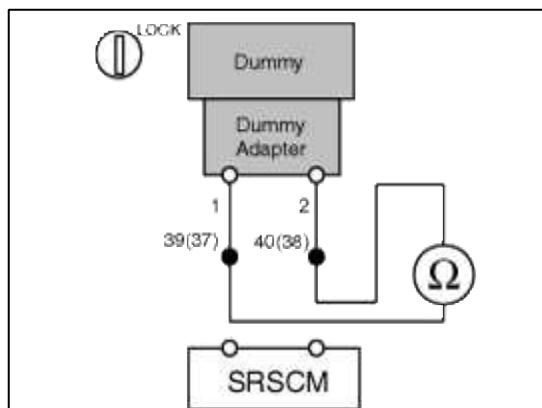
## 2. CHECK BPT RESISTANCE

### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 39(37) and 40(38) of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Seat Belt Pretensioner(BPT) module.

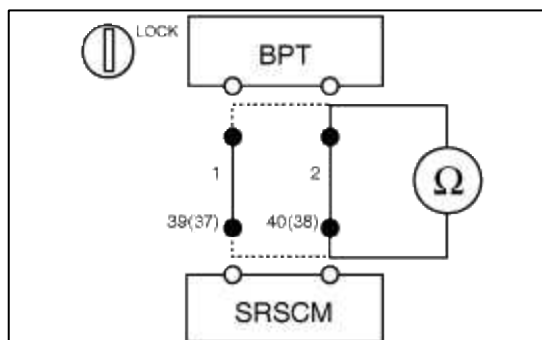
**NO**

Check open circuit.

## 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of BPT harness connector and the terminal 40(38) of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of BPT harness connector and the terminal 39(37) of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

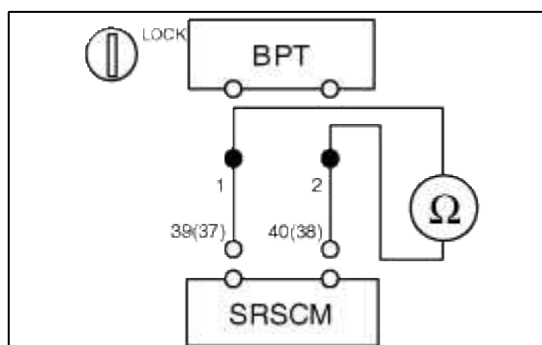
**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

#### 4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

Specification (resistance) : infinite



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1362 Pretensioner Front-Driver Resistance too Low

#### DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

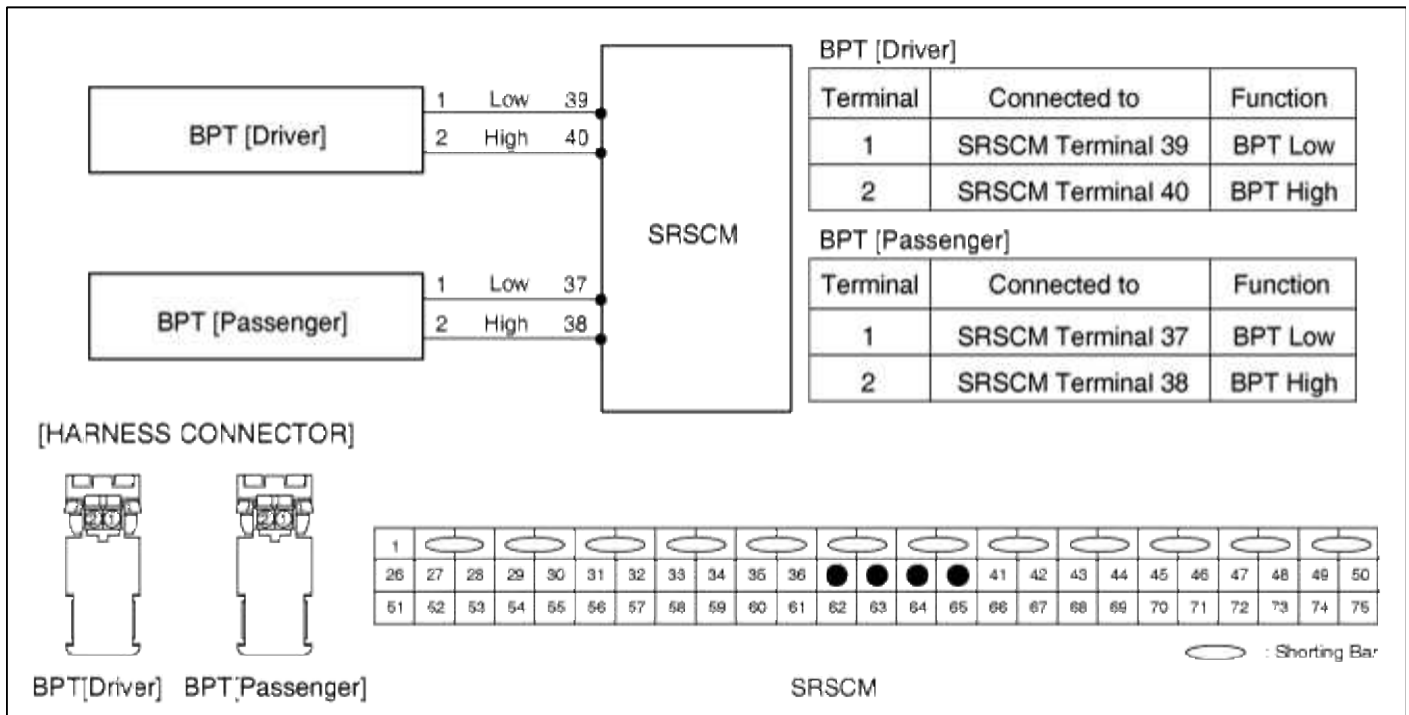
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	<ul style="list-style-type: none"> <li>Too high or low resistance between BPT high(+) and BPT low (-)</li> <li>Seat Belt Pretensioner (BPT) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Seat Belt Pretensioner (BPT) squib</li> <li>SRSCM</li> </ul>

#### Specification

BPT resistance : 1.4 ~ 4.5 Ω

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK BPT RESISTANCE

**CAUTION**

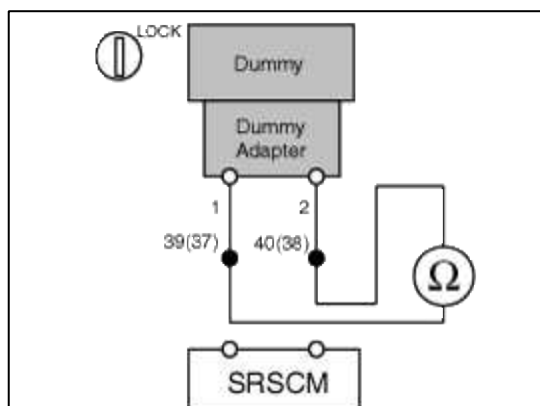
Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

(1) Connect the Dummy and the Dummy Adapter on BPT harness connector.

- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 39(37) and 40(38) of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Replace the Seat Belt Pretensioner(BPT) module.

**NO**

Check open circuit.

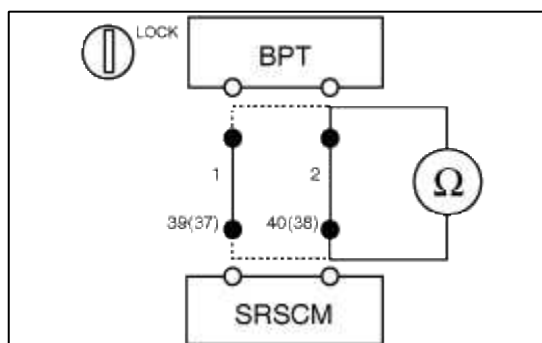
### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of BPT harness connector and the terminal 40(38) of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of BPT harness connector and the terminal 39(37) of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

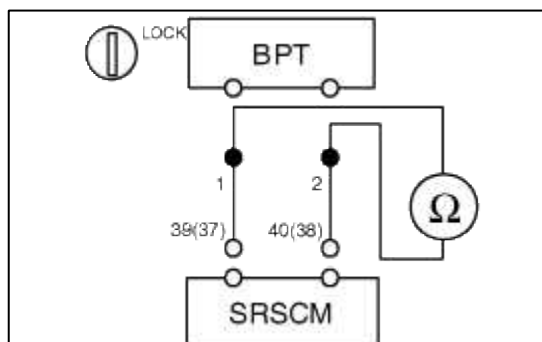
### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

---

Specification (resistance) : infinite

---



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

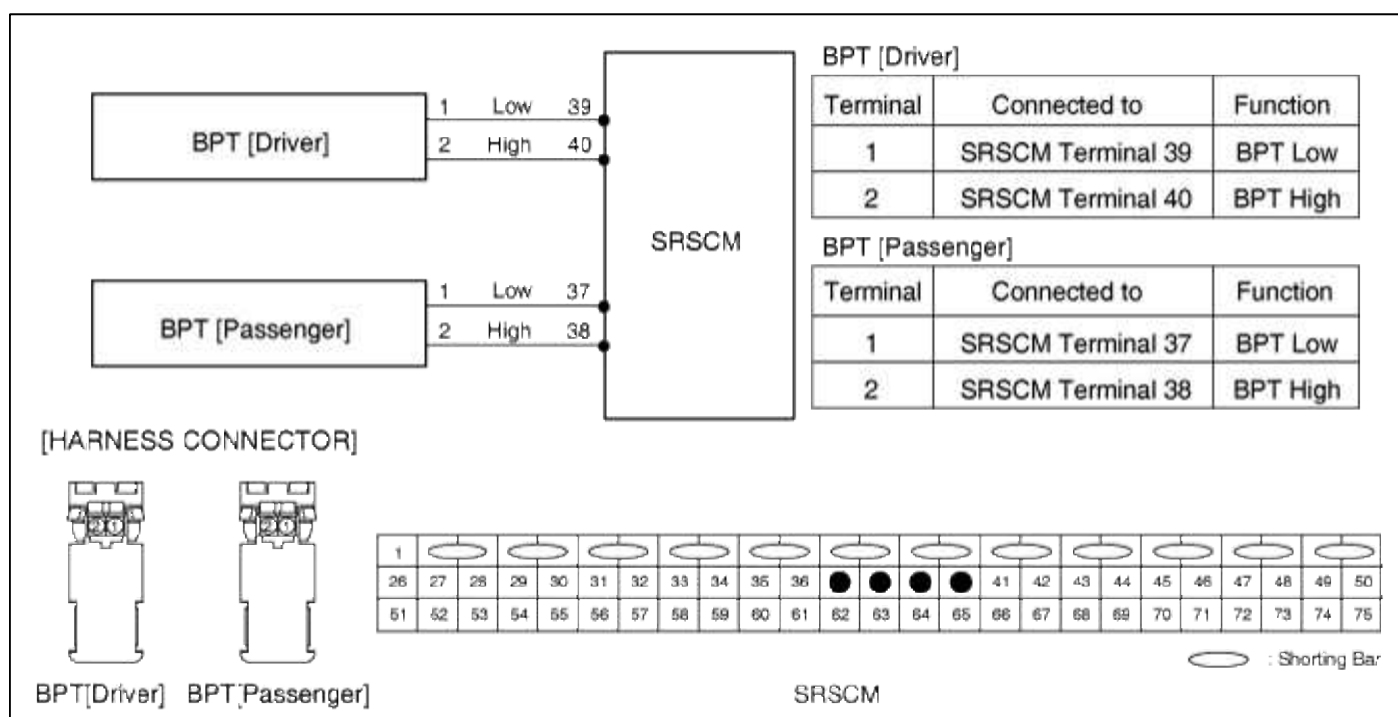
Refer to the DESCRIPTION in this TROUBLESHOOTING section.

**Restraint > Troubleshooting > B1363 Pretensioner front-Driver resistance circuit short to Ground**
**DTC Description**

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects short to ground on the BPT circuit.

**DTC Detecting Condition**

DTC	Condition	Probable cause
B1363 B1369	<ul style="list-style-type: none"> <li>• Short to ground between BPT and SRSCM</li> <li>• Seat Belt Pretensioner (BPT) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to ground circuit on wiring harness</li> <li>• Seat Belt Pretensioner (BPT) squib</li> <li>• SRSCM</li> </ul>

**Schematic Diagram**

**Terminal & Connector Inspection**

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

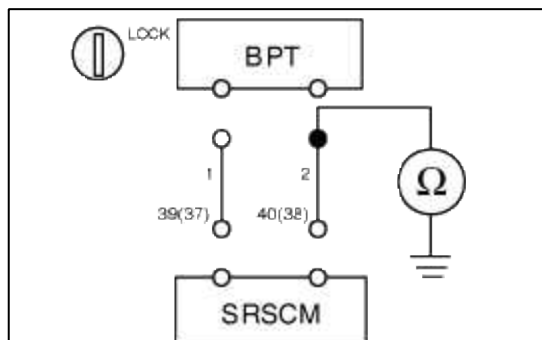
**Inspection Procedure**
**1. PREPARATION**

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 2 of BPT harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the BPT Module.

**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

## 3. CHECK THE BPT MODULE

- (1) Replace the Belt Pretensioner (BPT) with a new one.
  - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

**YES**

Go to next step.

**NO**

Replace BPT module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1364 Pretensioner front-Driver resistance circuit short to Battery

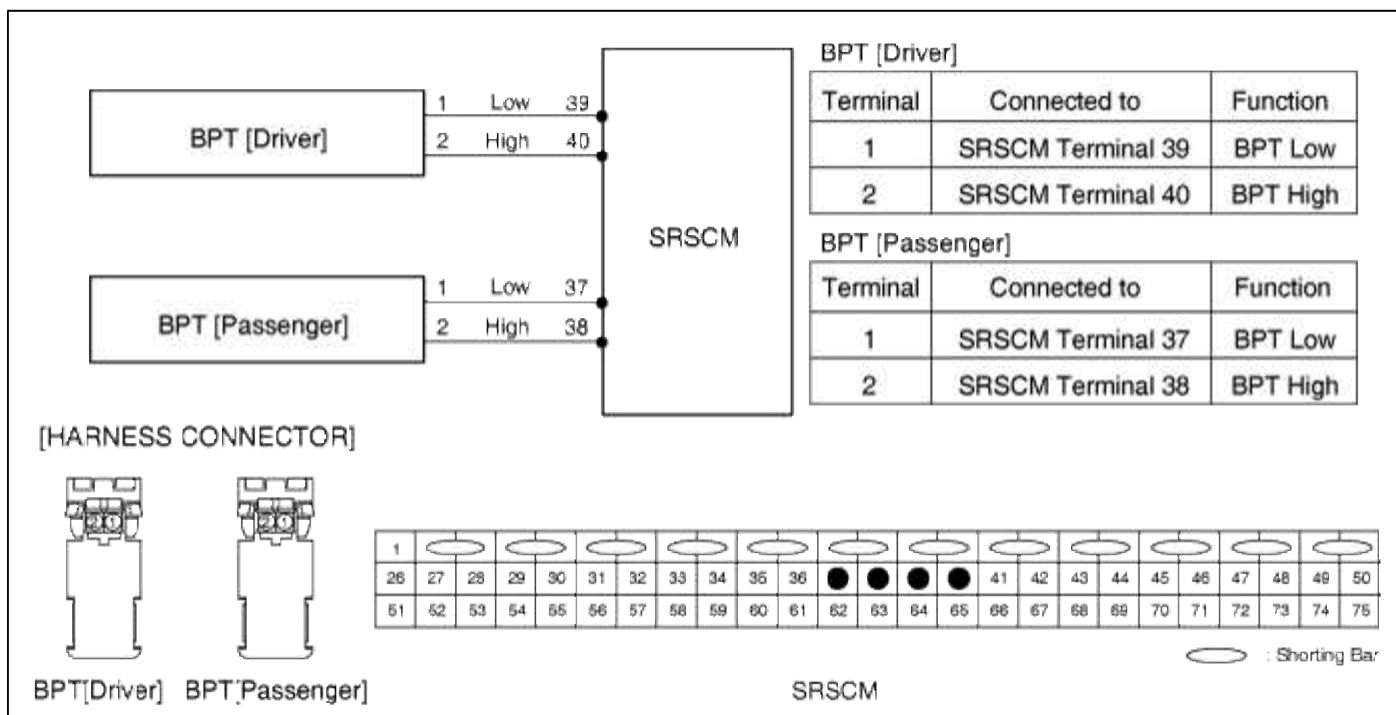
#### DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects short to battery line on the BPT circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1364 B1370	<ul style="list-style-type: none"> <li>• Short to battery line between BPT and SRSCM</li> <li>• Seat Belt Pretensioner (BPT) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to battery line circuit on wiring harness</li> <li>• Seat Belt Pretensioner (BPT) squib</li> <li>• SRSCM</li> </ul>

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.



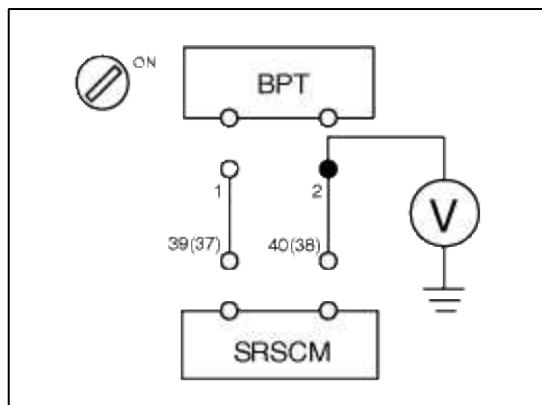
## 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2 of BPT harness connector and chassis ground.

---

Specification (voltage) : Approximately 0 V

---



- (4) Is the measured voltage within specification?

**YES**

Check the BPT Module.

**NO**

Repair the short to battery line circuit on wiring harness between the BPT and the SRSCM.

## 3. CHECK THE BPT MODULE

- (1) Replace the Belt Pretensioner (BPT) with a new one.
  - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

**YES**

Go to next step.

**NO**

Replace BPT module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1367 Pretensioner Front-Passenger Resistance too High

#### DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

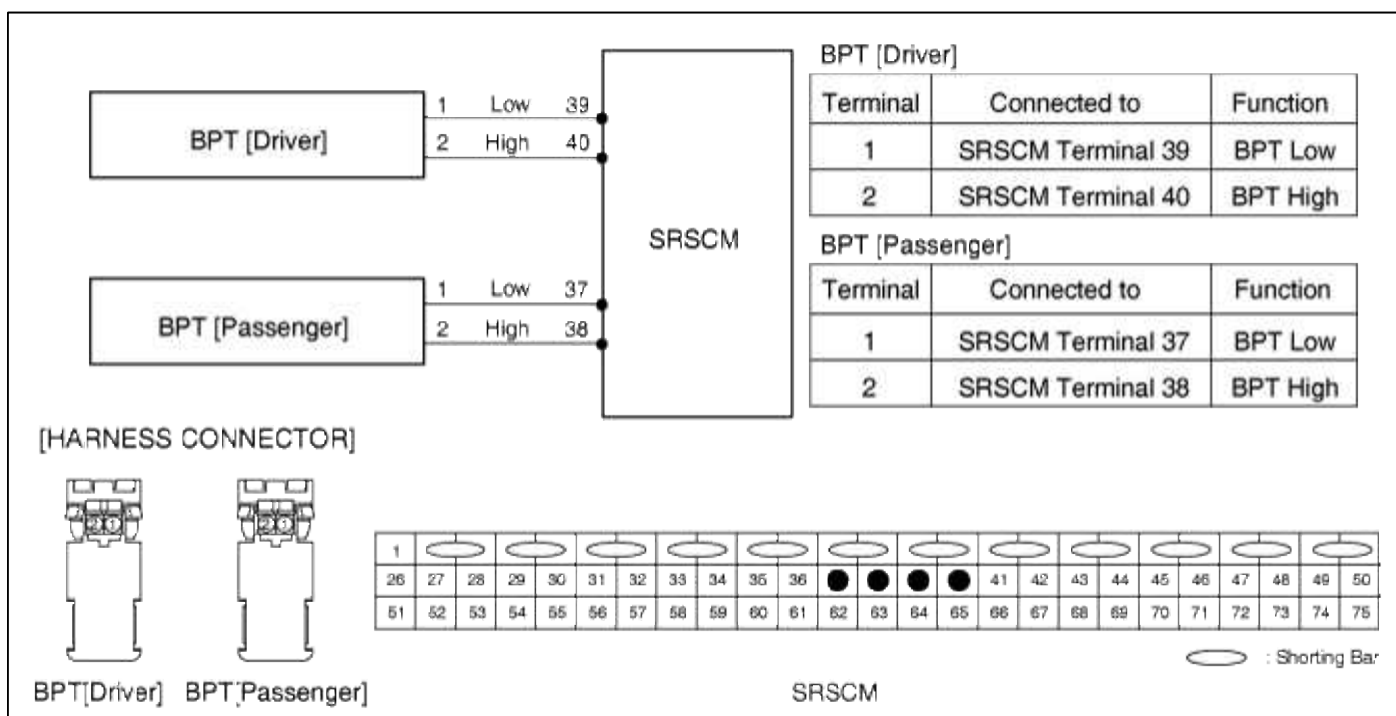
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	<ul style="list-style-type: none"> <li>Too high or low resistance between BPT high(+) and BPT low (-)</li> <li>Seat Belt Pretensioner (BPT) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Seat Belt Pretensioner (BPT) squib</li> <li>SRSCM</li> </ul>

## Specification

BPT resistance : 1.4 ~ 4.5  $\Omega$

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

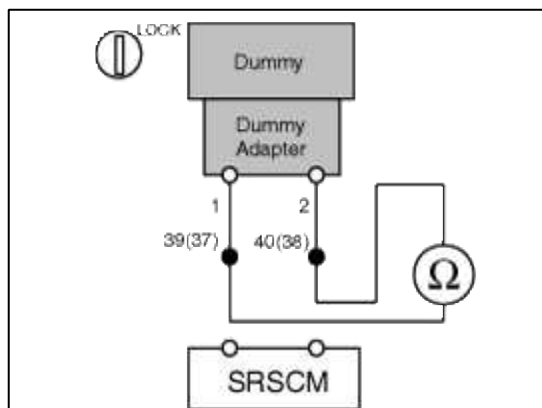
## 2. CHECK BPT RESISTANCE

### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 39(37) and 40(38) of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Seat Belt Pretensioner(BPT) module.

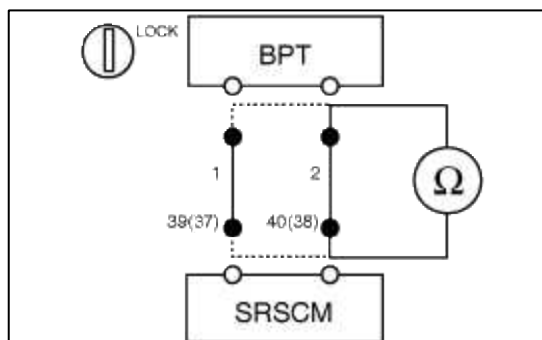
**NO**

Check open circuit.

## 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of BPT harness connector and the terminal 40(38) of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of BPT harness connector and the terminal 39(37) of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

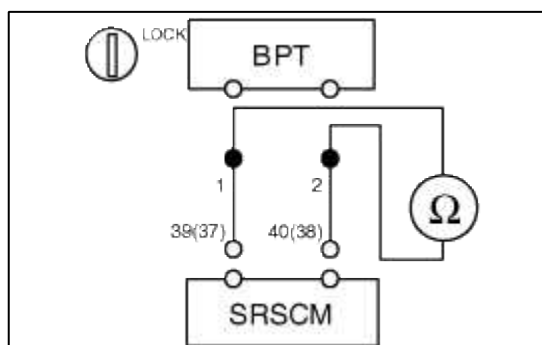
**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

#### 4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

Specification (resistance) : infinite



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1368 Pretensioner Front-Passenger Resistance too Low

#### DTC Description

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

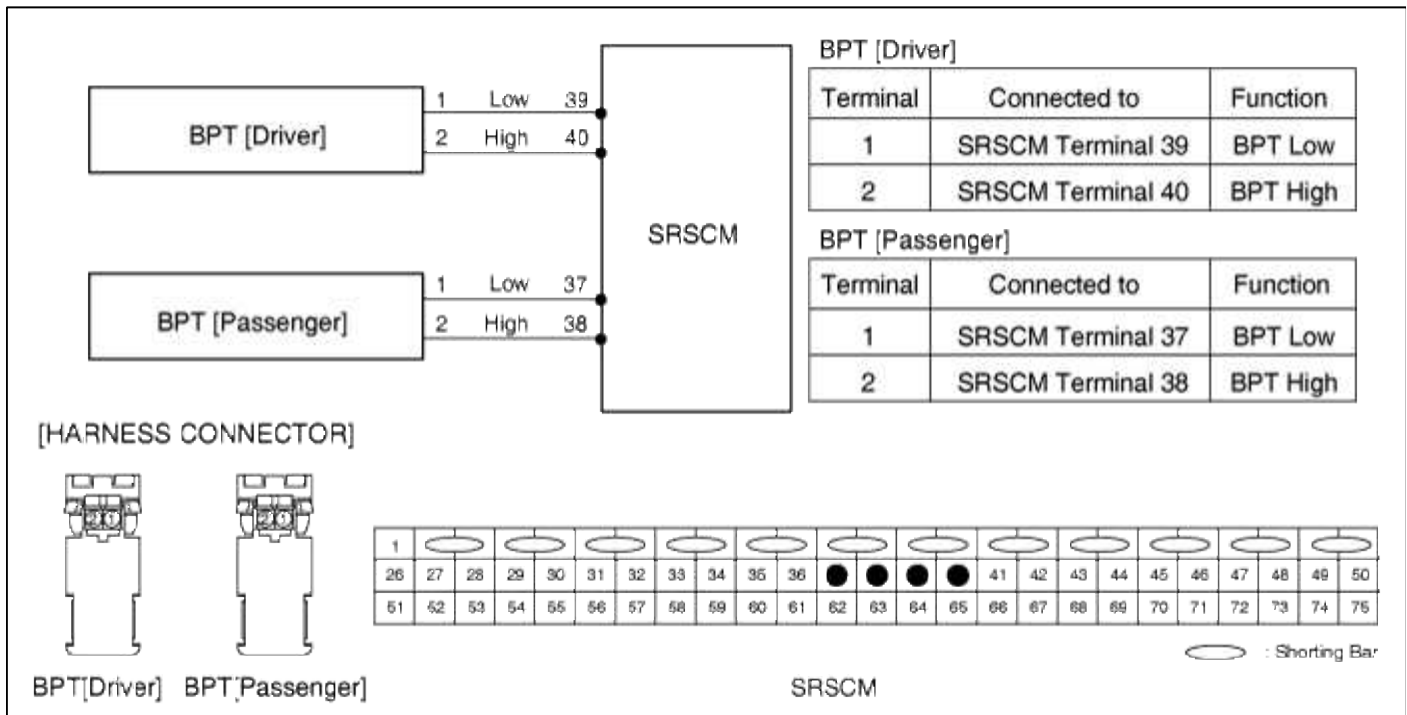
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	<ul style="list-style-type: none"> <li>Too high or low resistance between BPT high(+) and BPT low (-)</li> <li>Seat Belt Pretensioner (BPT) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Seat Belt Pretensioner (BPT) squib</li> <li>SRSCM</li> </ul>

#### Specification

BPT resistance : 1.4 ~ 4.5 Ω

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK BPT RESISTANCE

**CAUTION**

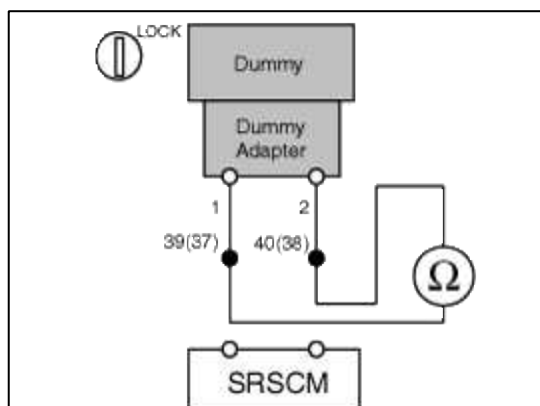
Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

(1) Connect the Dummy and the Dummy Adapter on BPT harness connector.

- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

(2) Measure resistance between the terminal 39(37) and 40(38) of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 4.5 Ω



(3) Is the measured resistance within specification?

**YES**

Replace the Seat Belt Pretensioner(BPT) module.

**NO**

Check open circuit.

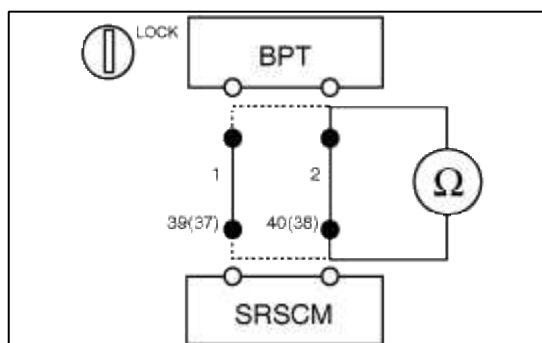
### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of BPT harness connector and the terminal 40(38) of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of BPT harness connector and the terminal 39(37) of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

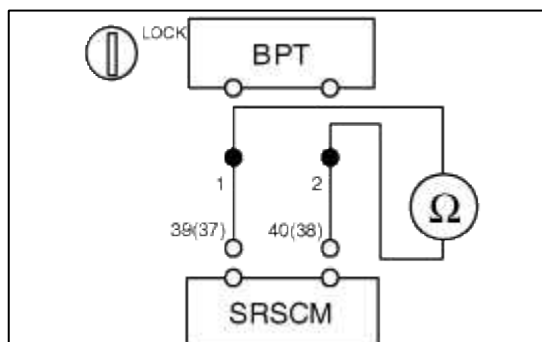
### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

---

Specification (resistance) : infinite

---



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Restraint > Troubleshooting > B1369 Pretensioner Front-Passenger Resistance Circuit Short to Ground

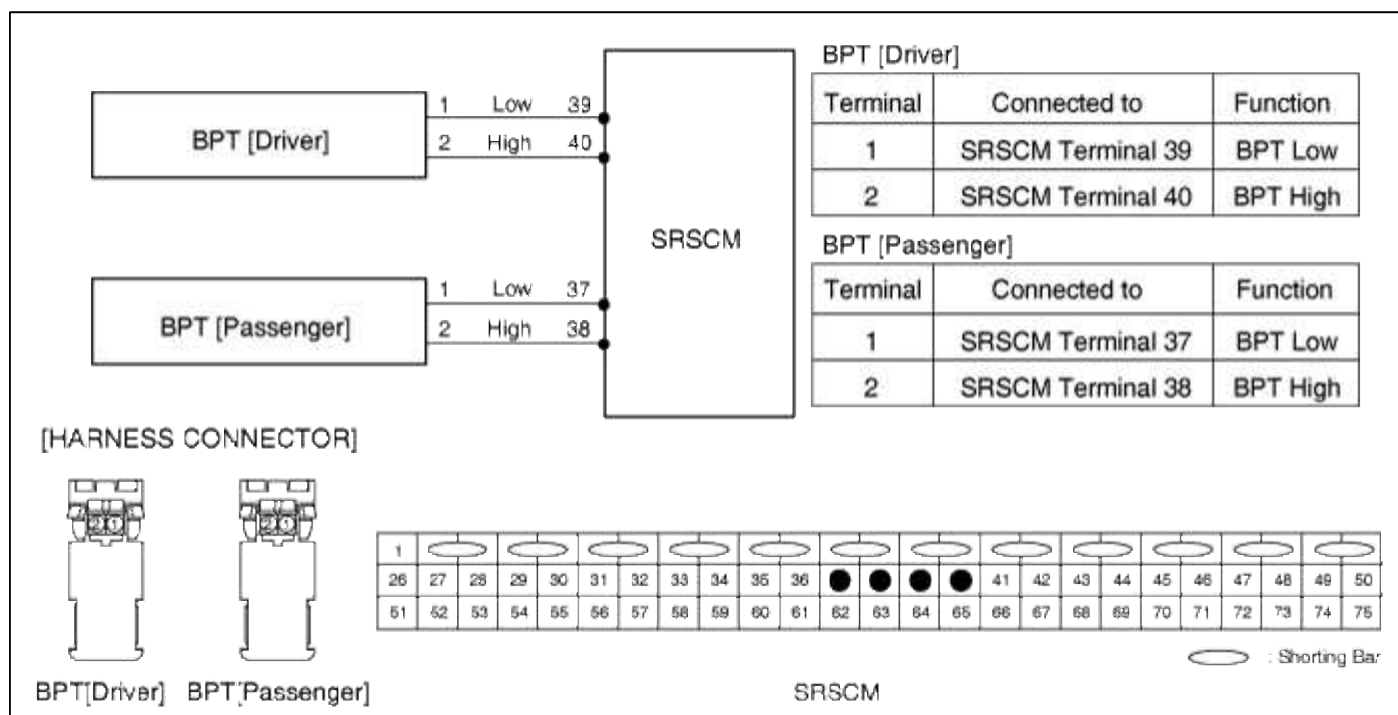
### DTC Description

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects short to ground on the BPT circuit.

### DTC Detecting Condition

DTC	Condition	Probable cause
B1363 B1369	<ul style="list-style-type: none"> <li>• Short to ground between BPT and SRSCM</li> <li>• Seat Belt Pretensioner (BPT) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to ground circuit on wiring harness</li> <li>• Seat Belt Pretensioner (BPT) squib</li> <li>• SRSCM</li> </ul>

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

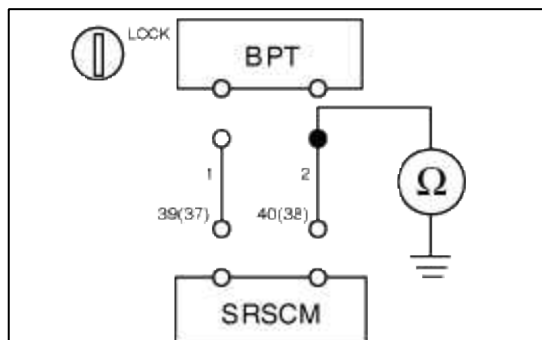
#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 2 of BPT harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the BPT Module.

**NO**

Repair or replace the wiring harness between the BPT and the SRSCM.

## 3. CHECK THE BPT MODULE

- (1) Replace the Belt Pretensioner (BPT) with a new one.
  - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

**YES**

Go to next step.

**NO**

Replace BPT module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1370 Pretensioner Front-Passenger Resistance Circuit Short to Battery

#### DTC Description

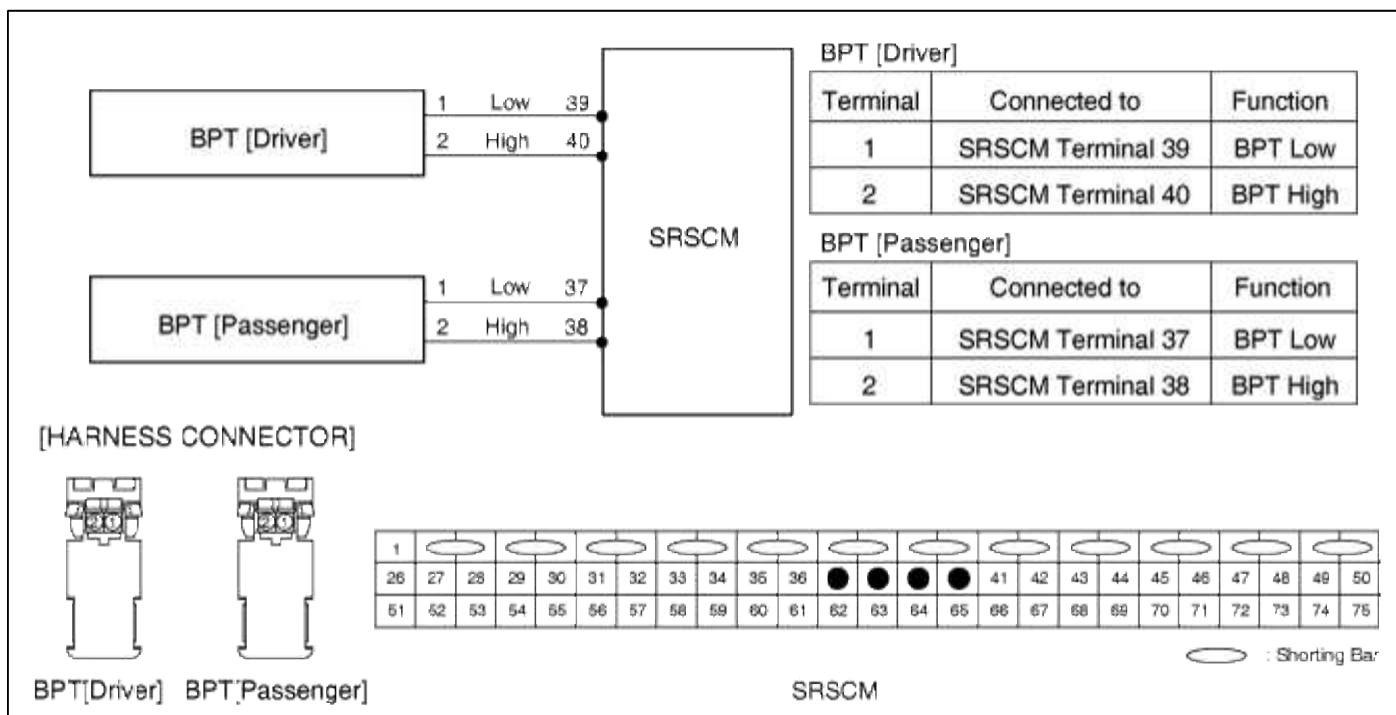
The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects short to battery line on the BPT circuit.

#### DTC Detecting Condition



DTC	Condition	Probable cause
B1364 B1370	<ul style="list-style-type: none"> <li>• Short to battery line between BPT and SRSCM</li> <li>• Seat Belt Pretensioner (BPT) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to battery line circuit on wiring harness</li> <li>• Seat Belt Pretensioner (BPT) squib</li> <li>• SRSCM</li> </ul>

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

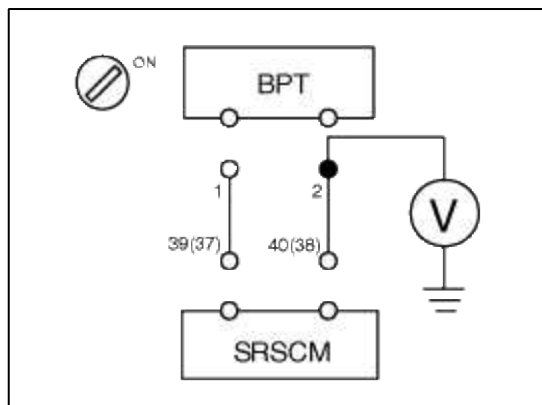
## 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2 of BPT harness connector and chassis ground.

---

Specification (voltage) : Approximately 0 V

---



- (4) Is the measured voltage within specification?

**YES**

Check the BPT Module.

**NO**

Repair the short to battery line circuit on wiring harness between the BPT and the SRSCM.

## 3. CHECK THE BPT MODULE

- (1) Replace the Belt Pretensioner (BPT) with a new one.
  - Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

**YES**

Go to next step.

**NO**

Replace BPT module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1400 SIS(Side Impact Sensor) Front-Driver defect

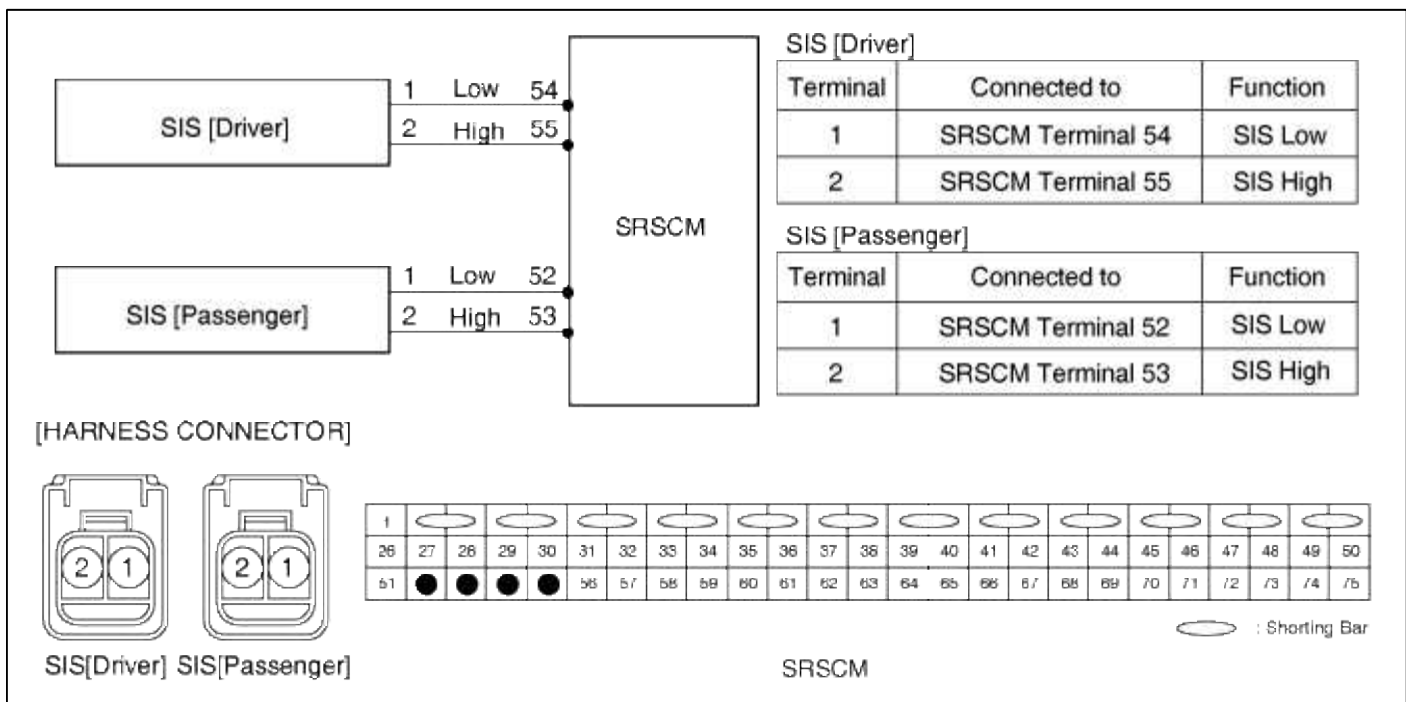
#### DTC Description

The detecting system for side crash consists of the SRSCM and four Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any SIS and the SRSCM.

## DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	<ul style="list-style-type: none"> <li>• Open between SIS and SRSCM</li> <li>• Side Impact Sensor (SIS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• Side Impact Sensor (SIS)</li> <li>• SRSCM</li> </ul>

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

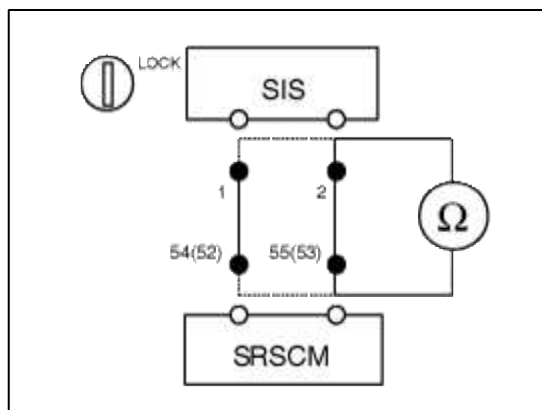
## 2. CHECK SIS CIRCUIT

- (1) Measure resistance between the terminal 2 of SIS harness connector and the terminal 55(53) of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of SIS harness connector and the terminal 54(52) of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



- (3) Is the measured resistance within specification?

**YES**

Check Side Impact Sensor.

**NO**

Repair or replace the wiring harness between the SIS and the SRSCM.

## 3. CHECK THE SIDE IMPACT SENSOR

- (1) Replace the Side Impact Sensor(SIS) with a new one.
  - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

**YES**

Go to next step.

**NO**

Replace SIS.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1403 SIS(Side Impact Sensor)Front-Passenger Defect

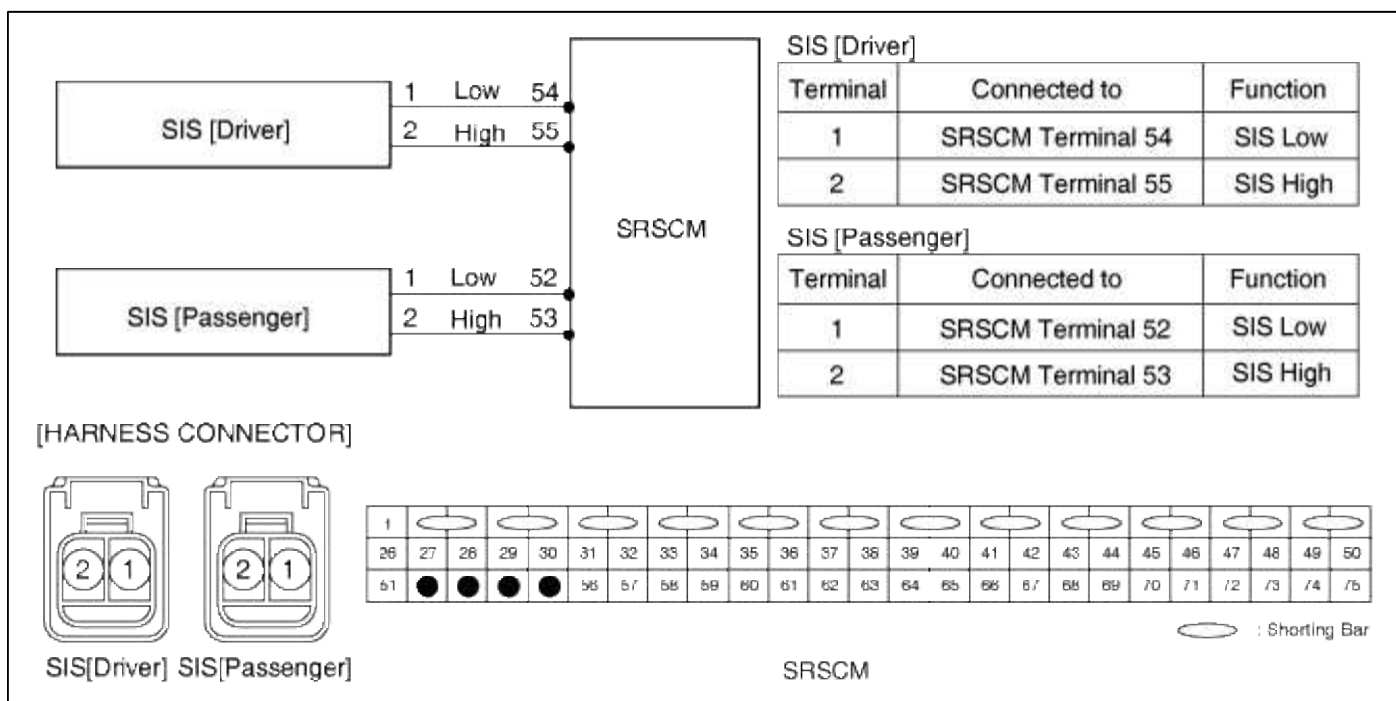
#### DTC Description

The detecting system for side crash consists of the SRSCM and four Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any SIS and the SRSCM.

## DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	<ul style="list-style-type: none"> <li>• Open between SIS and SRSCM</li> <li>• Side Impact Sensor (SIS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• Side Impact Sensor (SIS)</li> <li>• SRSCM</li> </ul>

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

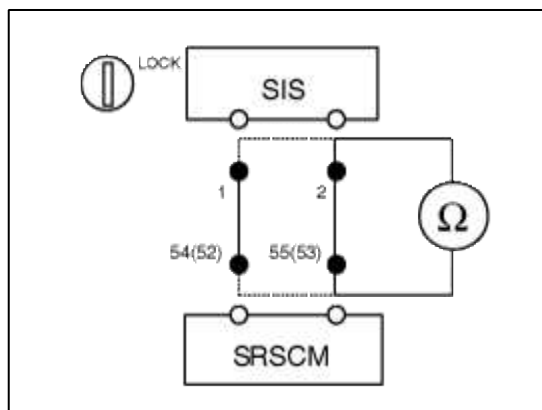
## 2. CHECK SIS CIRCUIT

- (1) Measure resistance between the terminal 2 of SIS harness connector and the terminal 55(53) of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of SIS harness connector and the terminal 54(52) of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



- (3) Is the measured resistance within specification?

**YES**

Check Side Impact Sensor.

**NO**

Repair or replace the wiring harness between the SIS and the SRSCM.

## 3. CHECK THE SIDE IMPACT SENSOR

- (1) Replace the Side Impact Sensor(SIS) with a new one.
  - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

**YES**

Go to next step.

**NO**

Replace SIS.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1409 SIS(Side Impact Sensor) Front-Driver Communication Error

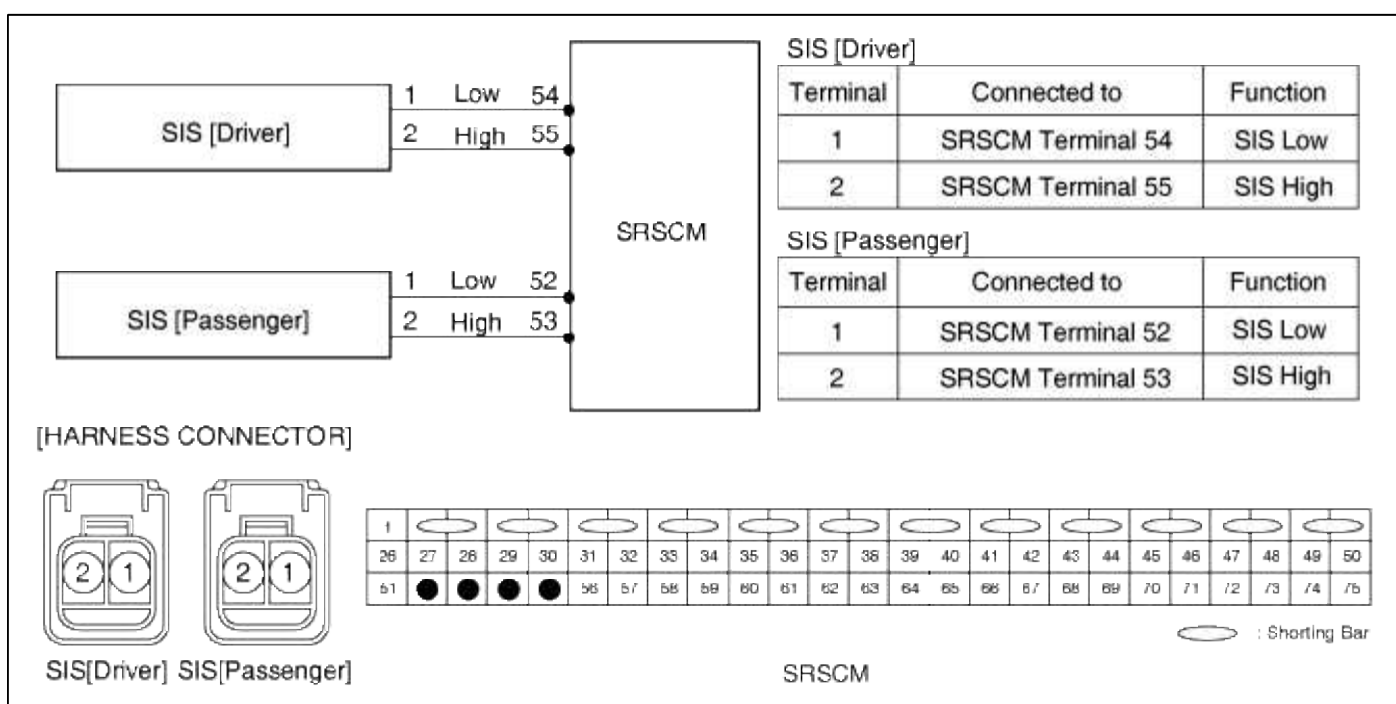
#### DTC Description

The detecting system for side crash consists of the SRSCM and four Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any SIS and the SRSCM.

## DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	<ul style="list-style-type: none"> <li>• Open between SIS and SRSCM</li> <li>• Side Impact Sensor (SIS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• Side Impact Sensor (SIS)</li> <li>• SRSCM</li> </ul>

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

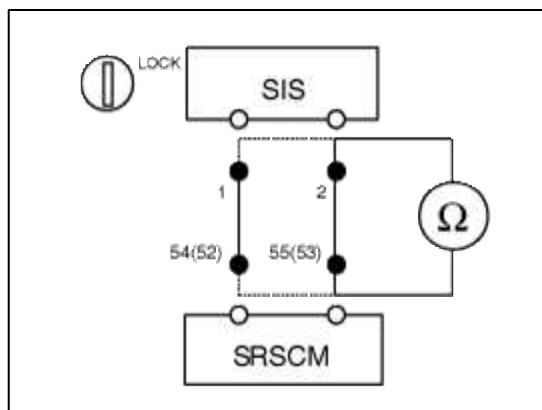
## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK SIS CIRCUIT

- (1) Measure resistance between the terminal 2 of SIS harness connector and the terminal 55(53) of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of SIS harness connector and the terminal 54(52) of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Check Side Impact Sensor.

**NO**

Repair or replace the wiring harness between the SIS and the SRSCM.

## 3. CHECK THE SIDE IMPACT SENSOR

- (1) Replace the Side Impact Sensor(SIS) with a new one.
  - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

**YES**

Go to next step.

**NO**

Replace SIS.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1410 SIS(Side Impact Sensor) Front-Passenger Communication Error

#### DTC Description

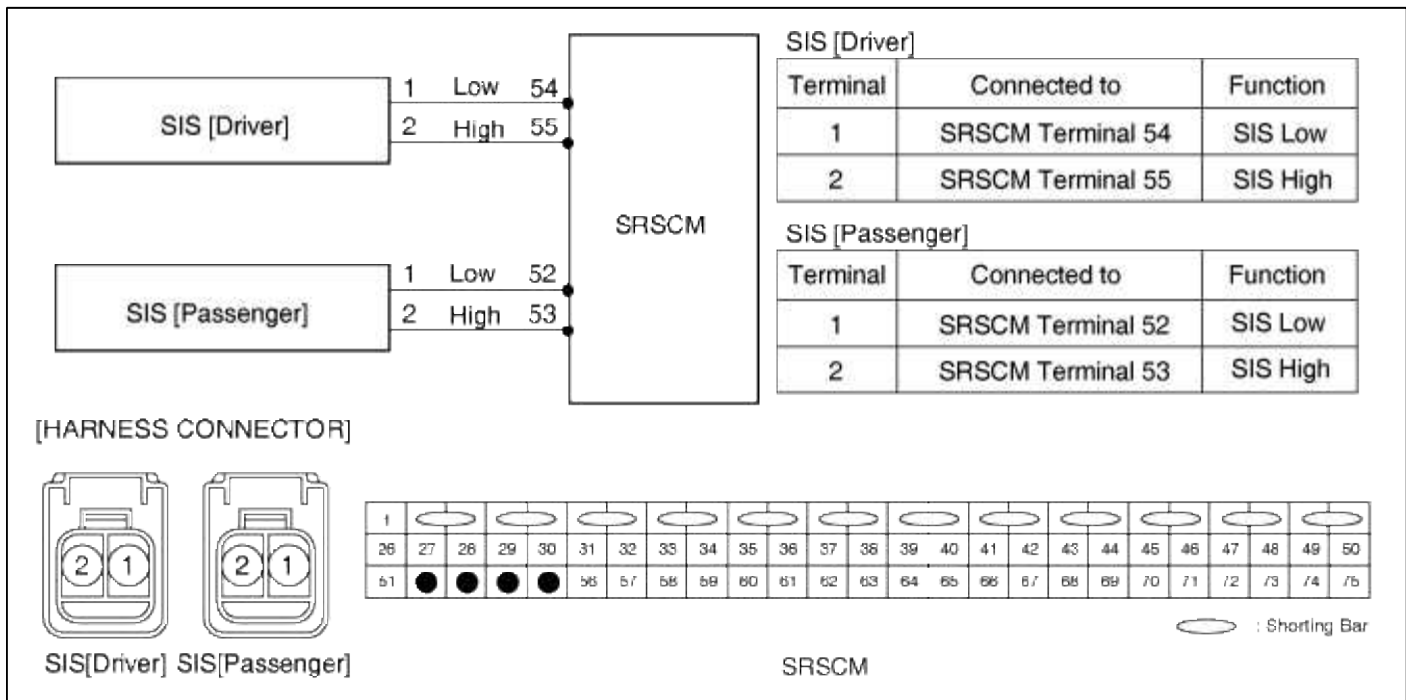
The detecting system for side crash consists of the SRSCM and four Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any SIS and the SRSCM.



## DTC Detecting Condition

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	<ul style="list-style-type: none"> <li>• Open between SIS and SRSCM</li> <li>• Side Impact Sensor (SIS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• Side Impact Sensor (SIS)</li> <li>• SRSCM</li> </ul>

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

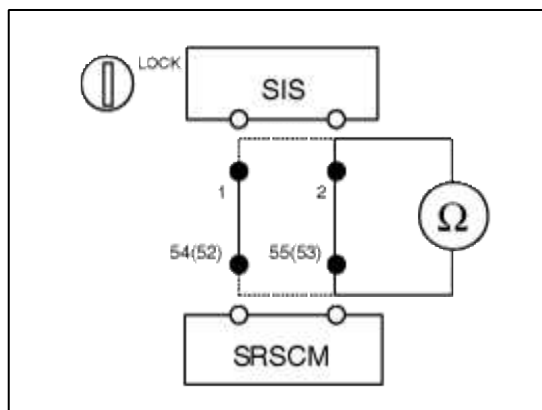
## 2. CHECK SIS CIRCUIT

- (1) Measure resistance between the terminal 2 of SIS harness connector and the terminal 55(53) of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of SIS harness connector and the terminal 54(52) of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



- (3) Is the measured resistance within specification?

**YES**

Check Side Impact Sensor.

**NO**

Repair or replace the wiring harness between the SIS and the SRSCM.

## 3. CHECK THE SIDE IMPACT SENSOR

- (1) Replace the Side Impact Sensor(SIS) with a new one.
  - Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

**YES**

Go to next step.

**NO**

Replace SIS.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1447 OC(Occupant Classification)-Passenger ECU Defect

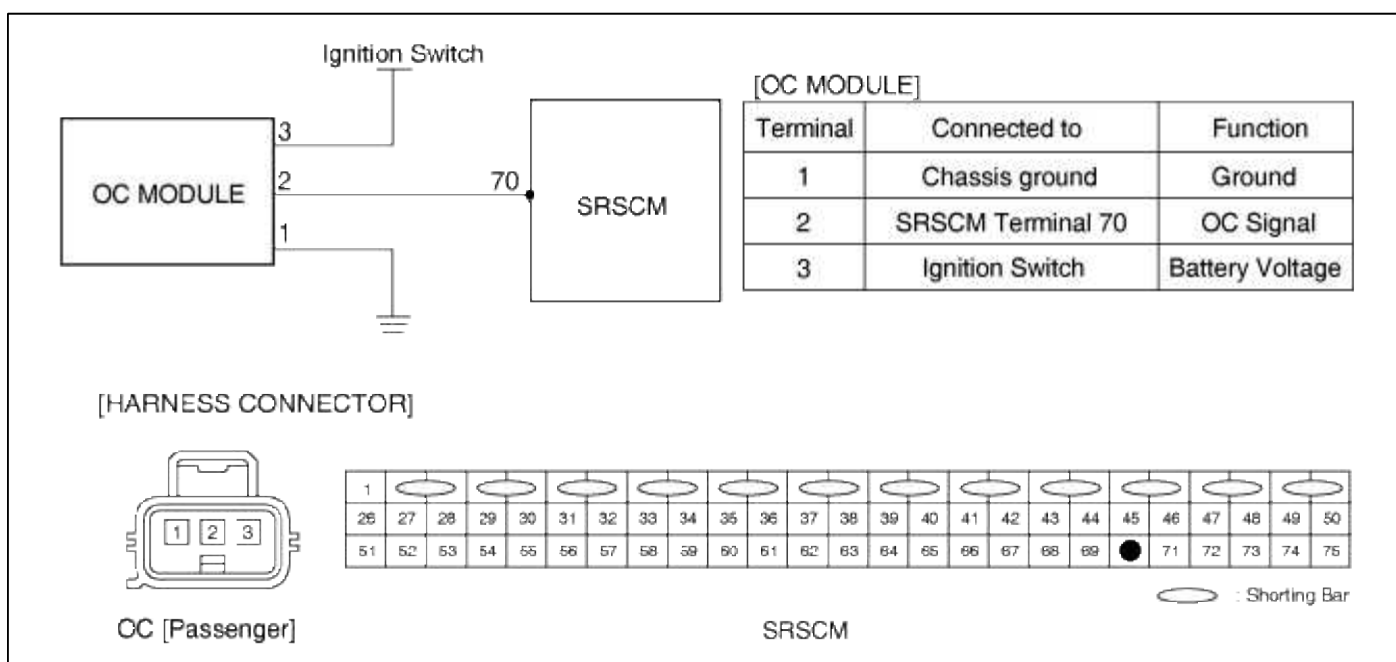
#### DTC Description

The passenger occupant classification (OC) system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

## DTC Detecting Condition

DTC	Condition	Probable cause
B1447 B1448 B1449 B1450	<ul style="list-style-type: none"> <li>• OC module Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• OC module</li> <li>• SRSCM</li> </ul>

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

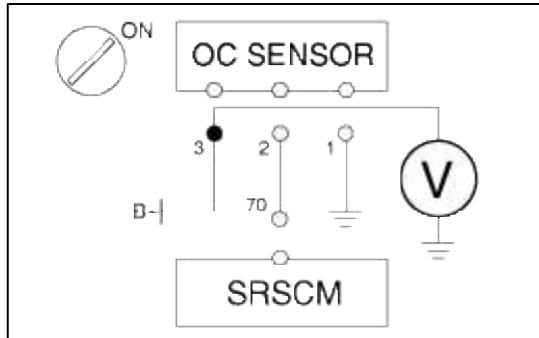
## 2. CHECK POWER TO OC SENSOR

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 3 of OC Sensor harness connector and chassis ground.

---

specification(voltage) : Battery voltage

---



- (4) Is the measured voltage within specification?

**YES**

Check short to battery line.

**NO**

Repair or replace the wiring harness between the OC Sensor and ignition switch.

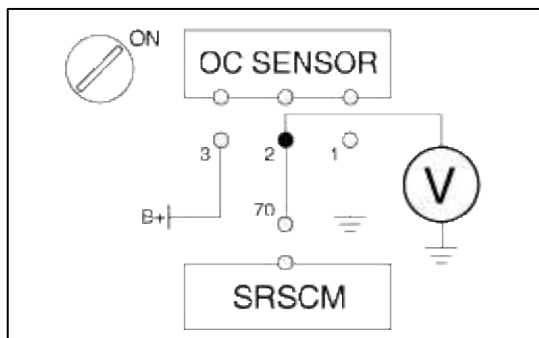
## 3. CHECK SHORT TO BATTERY LINE

- (1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

---

specification(voltage) : Approximately 0 V

---



- (2) Is the measured voltage within specification?

**YES**

Check short to ground.

**NO**

Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

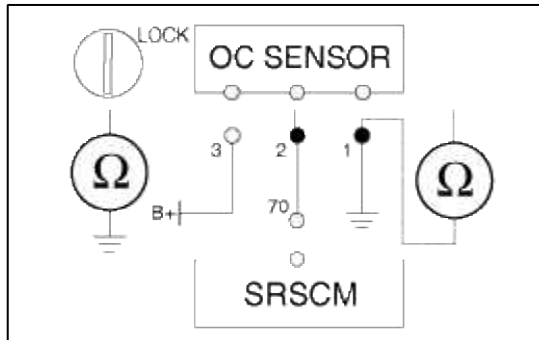
#### 4. CHECK SHORT TO GROUND

- (1) Turn the ignition switch to LOCK.
- (2) Disconnect the battery negative cable from the battery.
- (3) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.
- (4) Measure resistance between the terminal 2 and 1 of OC Sensor harness connector

---

Specification(resistance) : Infinite

---



- (5) Is the measured resistance within specification?

**YES**

Check OC Sensor Circuit.

**NO**

Repair or replace the wiring harness between the OC Sensor and the SRSCM.

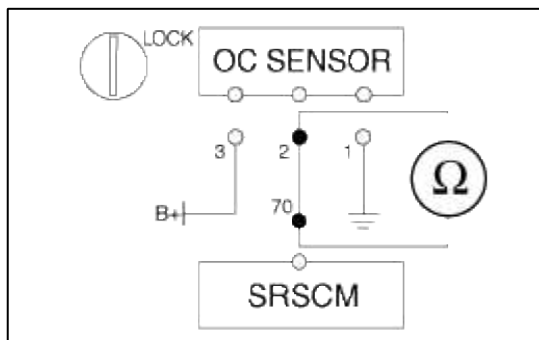
#### 5. CHECK OC SENSOR CIRCUIT

- (1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 70 of the SRSCM harness connector.

---

specification(resistance) : below 1  $\Omega$

---



- (2) Is the measured resistance within specification?

**YES**

Check OC Sensor.

**NO**

Repair or replace the wiring harness between the OC Sensor and the SRSCM.

## 6. CHECK OC SENSOR

- (1) Replace the OC Sensor with a new one.
  - Refer to "OC SENSOR" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect the a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.
- (8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

**YES**

Go to next step.

**NO**

Replace the OC Sensor.

## 7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1448 OC(Occupant Classification)-Passenger Sensor Mat Defect

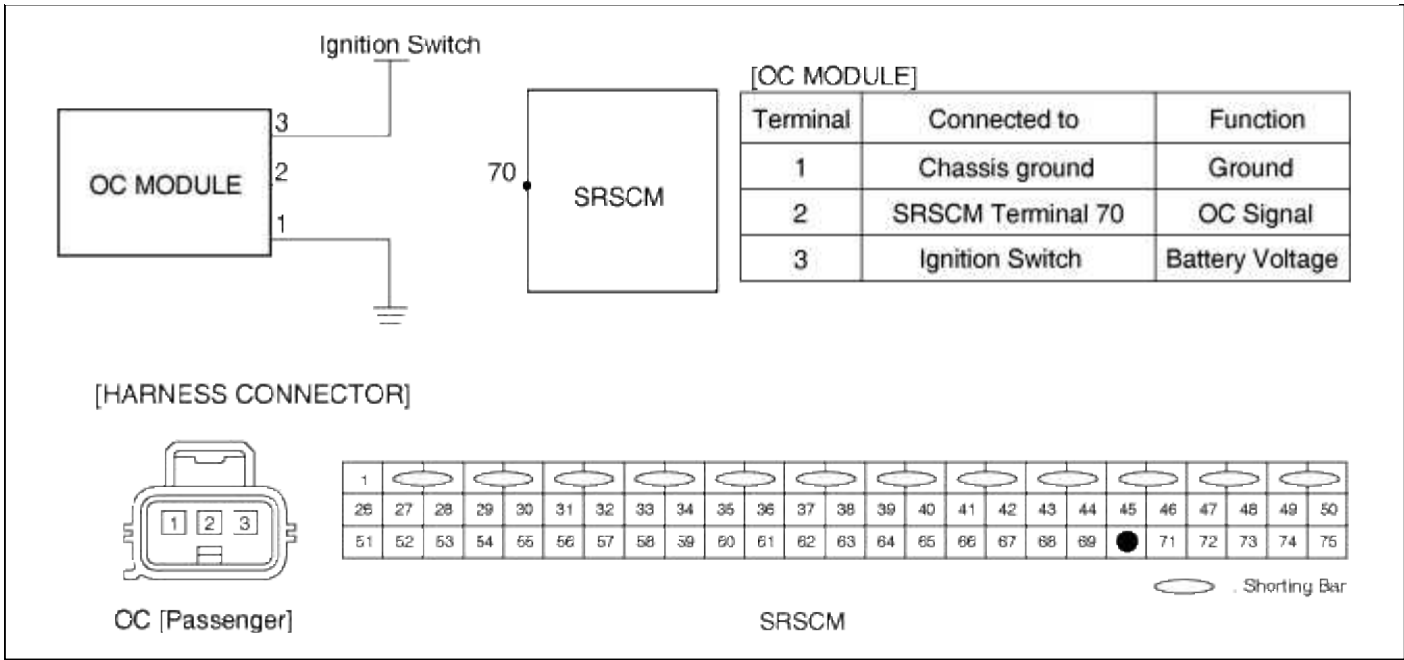
#### DTC Description

The passenger occupant classification (OC) system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1447 B1448 B1449 B1450	<ul style="list-style-type: none"> <li>• OC module Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• OC module</li> <li>• SRSCM</li> </ul>

#### Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

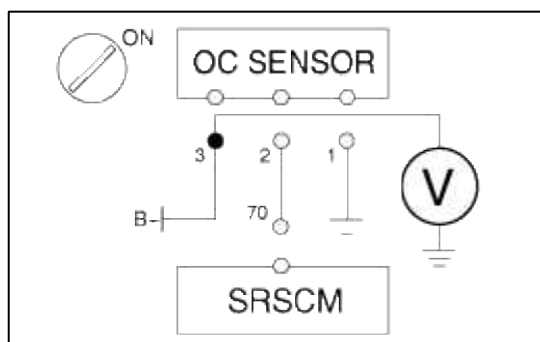
## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK POWER TO OC SENSOR

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 3 of OC Sensor harness connector and chassis ground.

specification(voltage) : Battery voltage



- (4) Is the measured voltage within specification?

**YES**

Check short to battery line.

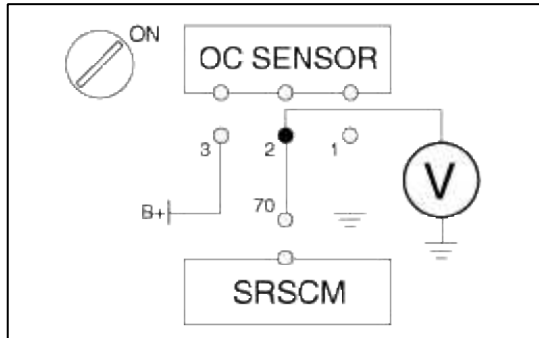
NO

Repair or replace the wiring harness between the OC Sensor and ignition switch.

### 3. CHECK SHORT TO BATTERY LINE

- (1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

specification(voltage) : Approximately 0 V



- (2) Is the measured voltage within specification?

**YES**

Check short to ground.

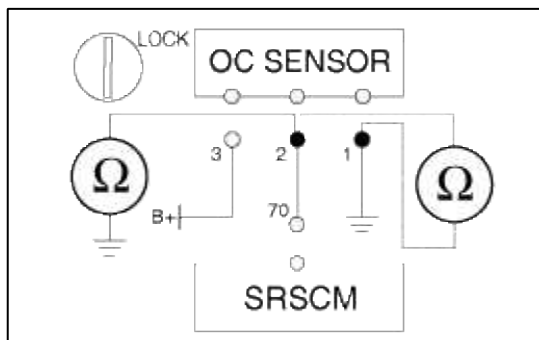
**NO**

Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

### 4. CHECK SHORT TO GROUND

- (1) Turn the ignition switch to LOCK.  
 (2) Disconnect the battery negative cable from the battery.  
 (3) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.  
 (4) Measure resistance between the terminal 2 and 1 of OC Sensor harness connector

Specification(resistance) : Infinite



- (5) Is the measured resistance within specification?

**YES**

Check OC Sensor Circuit.

**NO**

Repair or replace the wiring harness between the OC Sensor and the SRSCM.



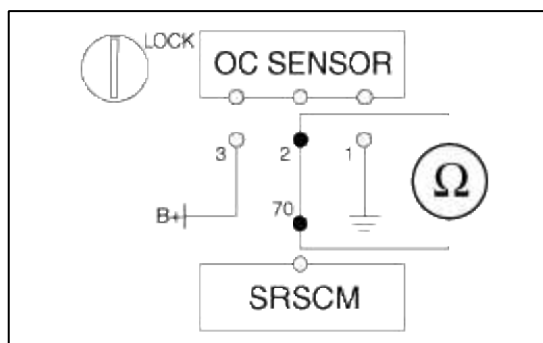
## 5. CHECK OC SENSOR CIRCUIT

- (1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 70 of the SRSCM harness connector.

---

specification(resistance) : below 1  $\Omega$

---



- (2) Is the measured resistance within specification?

**YES**

Check OC Sensor.

**NO**

Repair or replace the wiring harness between the OC Sensor and the SRSCM.

## 6. CHECK OC SENSOR

- (1) Replace the OC Sensor with a new one.
  - Refer to "OC SENSOR" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect the a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.
- (8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

**YES**

Go to next step.

**NO**

Replace the OC Sensor.

## 7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1449 OC(Occupant Classification)-Passenger Communication Error

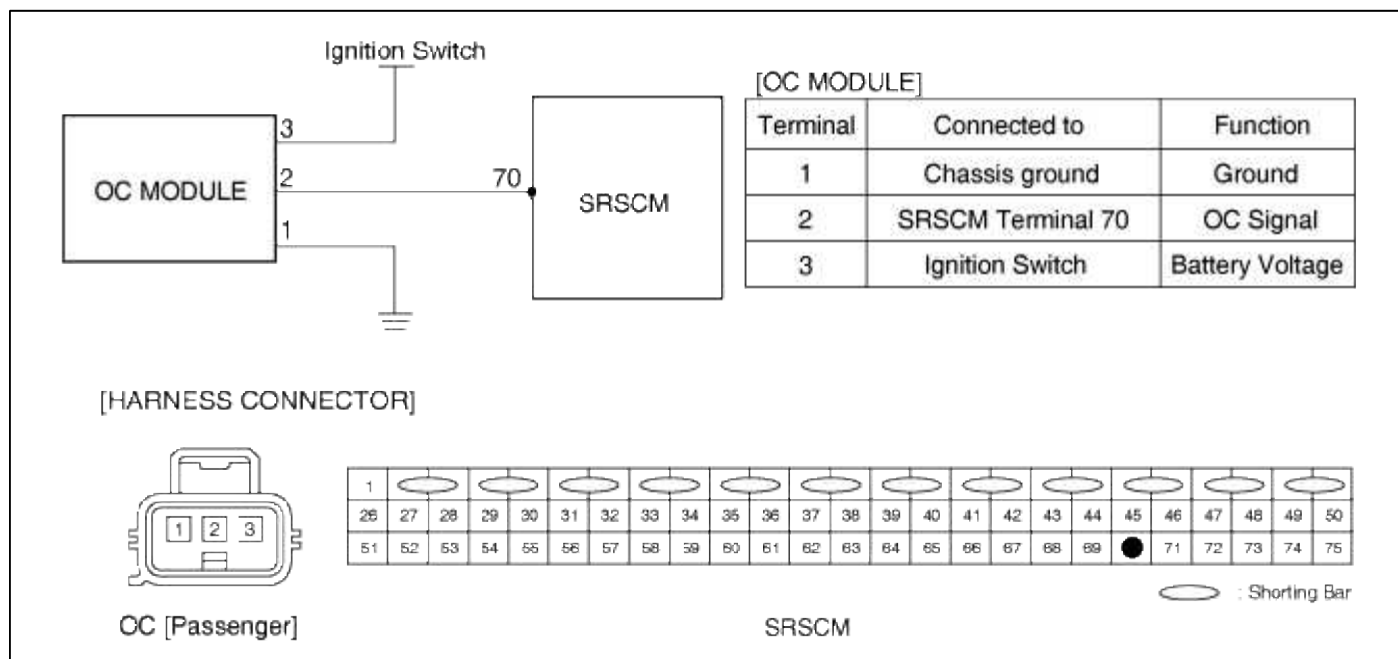
#### DTC Description

The passenger occupant classification (OC) system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1447 B1448 B1449 B1450	<ul style="list-style-type: none"> <li>• OC module Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• OC module</li> <li>• SRSCM</li> </ul>

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

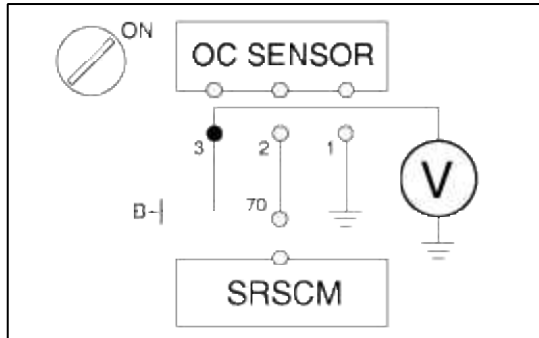
## 2. CHECK POWER TO OC SENSOR

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 3 of OC Sensor harness connector and chassis ground.

---

specification(voltage) : Battery voltage

---



- (4) Is the measured voltage within specification?

**YES**

Check short to battery line.

**NO**

Repair or replace the wiring harness between the OC Sensor and ignition switch.

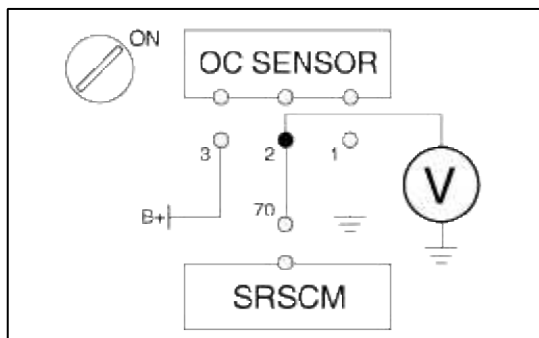
## 3. CHECK SHORT TO BATTERY LINE

- (1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

---

specification(voltage) : Approximately 0 V

---



- (2) Is the measured voltage within specification?

**YES**

Check short to ground.

**NO**

Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

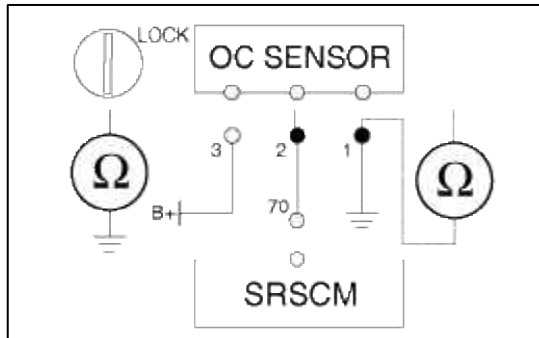
#### 4. CHECK SHORT TO GROUND

- (1) Turn the ignition switch to LOCK.
- (2) Disconnect the battery negative cable from the battery.
- (3) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.
- (4) Measure resistance between the terminal 2 and 1 of OC Sensor harness connector

---

Specification(resistance) : Infinite

---



- (5) Is the measured resistance within specification?

**YES**

Check OC Sensor Circuit.

**NO**

Repair or replace the wiring harness between the OC Sensor and the SRSCM.

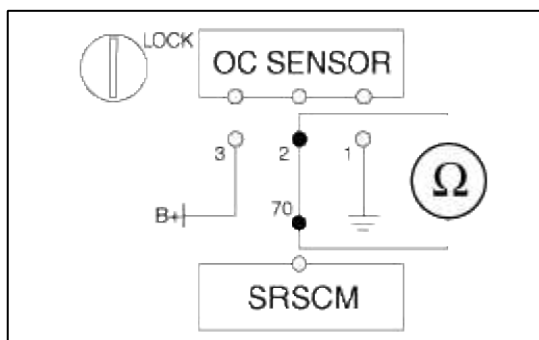
#### 5. CHECK OC SENSOR CIRCUIT

- (1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 70 of the SRSCM harness connector.

---

specification(resistance) : below 1  $\Omega$

---



- (2) Is the measured resistance within specification?

**YES**

Check OC Sensor.

**NO**

Repair or replace the wiring harness between the OC Sensor and the SRSCM.

## 6. CHECK OC SENSOR

- (1) Replace the OC Sensor with a new one.
  - Refer to "OC SENSOR" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect the a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.
- (8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

**YES**

Go to next step.

**NO**

Replace the OC Sensor.

## 7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1450 OC(Occupant Classification)-Passenger Wrong ID

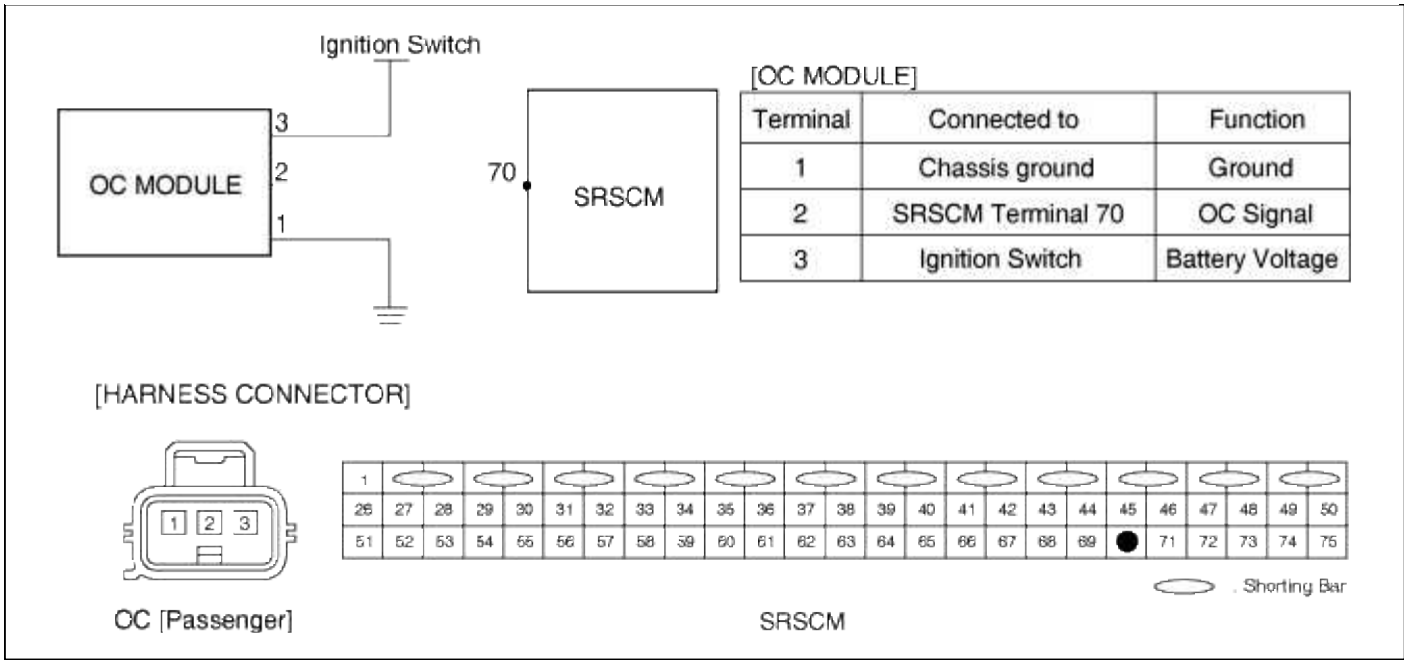
#### DTC Description

The passenger occupant classification (OC) system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1447 B1448 B1449 B1450	<ul style="list-style-type: none"> <li>• OC module Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring Harness</li> <li>• OC module</li> <li>• SRSCM</li> </ul>

#### Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

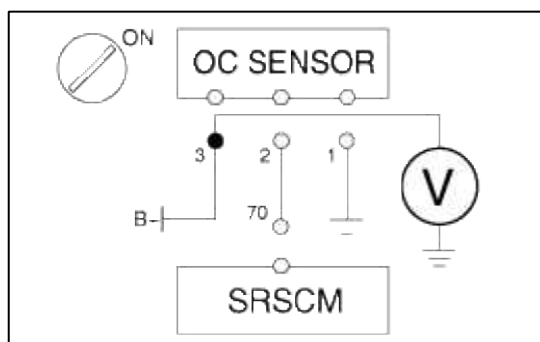
## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK POWER TO OC SENSOR

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 3 of OC Sensor harness connector and chassis ground.

specification(voltage) : Battery voltage



- (4) Is the measured voltage within specification?

**YES**

Check short to battery line.

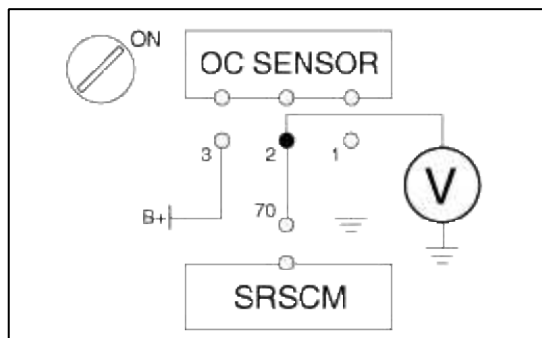
NO

Repair or replace the wiring harness between the OC Sensor and ignition switch.

### 3. CHECK SHORT TO BATTERY LINE

- (1) Measure voltage between the terminal 2 of OC Sensor harness connector and chassis ground.

specification(voltage) : Approximately 0 V



- (2) Is the measured voltage within specification?

**YES**

Check short to ground.

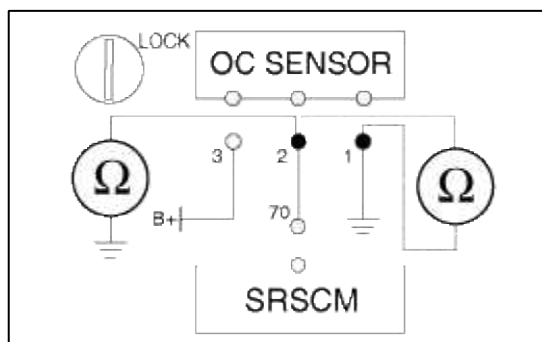
**NO**

Repair the short to battery line circuit on wiring harness between the OC Sensor and the SRSCM.

### 4. CHECK SHORT TO GROUND

- (1) Turn the ignition switch to LOCK.  
 (2) Disconnect the battery negative cable from the battery.  
 (3) Measure resistance between the terminal 2 of OC Sensor harness connector and chassis ground.  
 (4) Measure resistance between the terminal 2 and 1 of OC Sensor harness connector

Specification(resistance) : Infinite



- (5) Is the measured resistance within specification?

**YES**

Check OC Sensor Circuit.

**NO**

Repair or replace the wiring harness between the OC Sensor and the SRSCM.

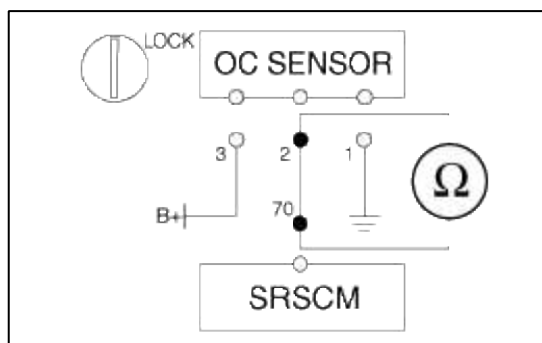
## 5. CHECK OC SENSOR CIRCUIT

- (1) Measure resistance between the terminal 2 of OC Sensor harness connector and the terminal 70 of the SRSCM harness connector.

---

specification(resistance) : below 1  $\Omega$

---



- (2) Is the measured resistance within specification?

**YES**

Check OC Sensor.

**NO**

Repair or replace the wiring harness between the OC Sensor and the SRSCM.

## 6. CHECK OC SENSOR

- (1) Replace the OC Sensor with a new one.
  - Refer to "OC SENSOR" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect the a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.
- (8) Does Hi-Scan(Pro) indicate any DTC related to OC Sensor?

**YES**

Go to next step.

**NO**

Replace the OC Sensor.

## 7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1473 Inflatable Curtain Airbag Front-Driver Resistance too High

#### DTC Description

The CAB squib circuit consists of the SRSCM and two Curtain Airbags(CAB). It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

#### DTC Detecting Condition

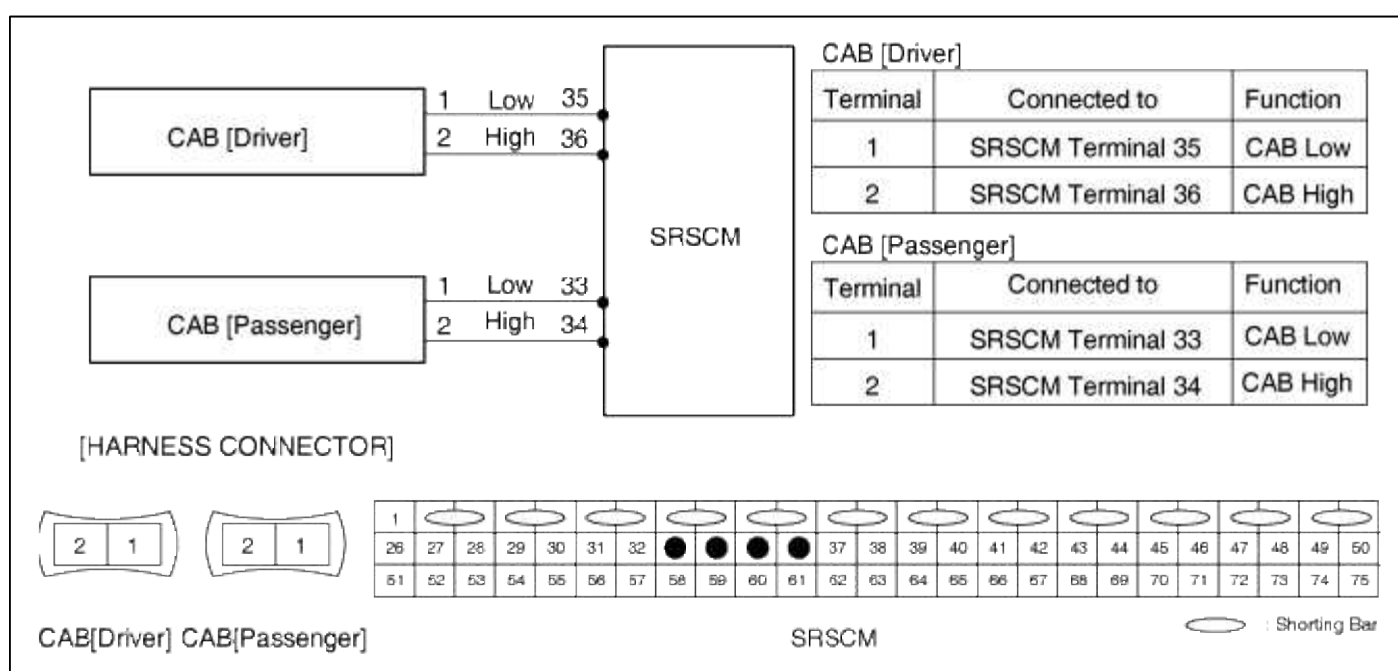


DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	<ul style="list-style-type: none"> <li>Too high or low resistance between CAB high(+) and CAB low(-)</li> <li>Curtain Airbag (CAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Curtain Airbag (CAB) squib</li> <li>SRSCM</li> </ul>

## Specification

CAB resistance : 1.4 ~ 4.5  $\Omega$

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

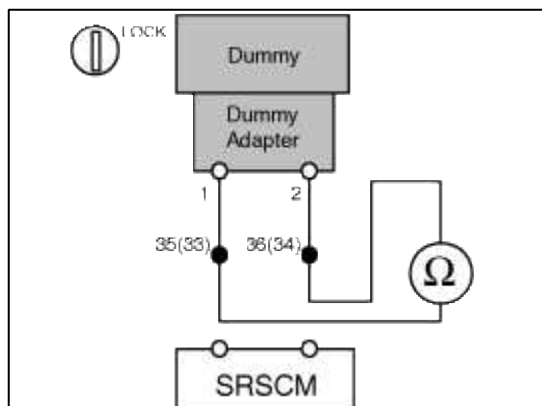
## 2. CHECK CAB RESISTANCE

### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 35(33) and 36(34) of SRSCM harness connector(B).

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Curtain Airbag(CAB) module.

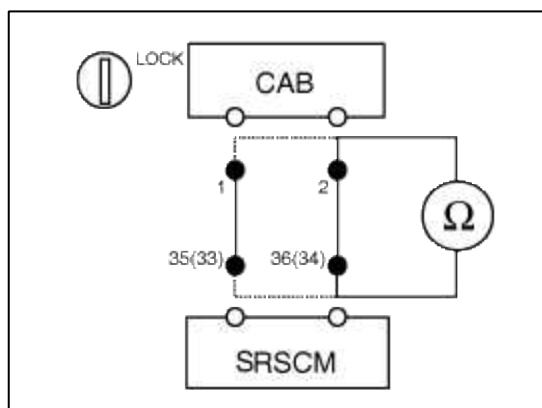
**NO**

Check open circuit.

## 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 36(34) of SRSCM harness connector(B).
- (2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 35(33) of SRSCM harness connector(B).

Specification (resistance) : below 1  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

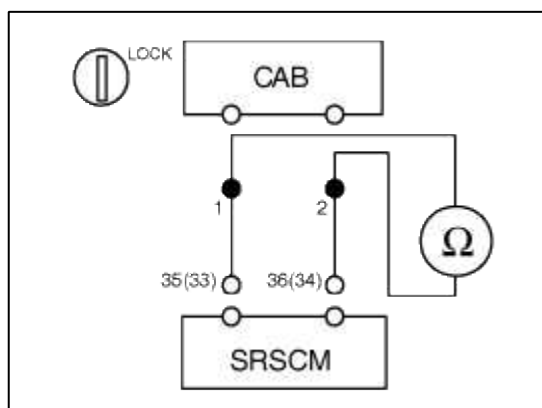
**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

#### 4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

Specification (resistance) : infinite



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1474 Inflatable Curtain Airbag Front-Driver Resistance too Low

#### DTC Description

The CAB squib circuit consists of the SRSCM and two Curtain Airbags(CAB). It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

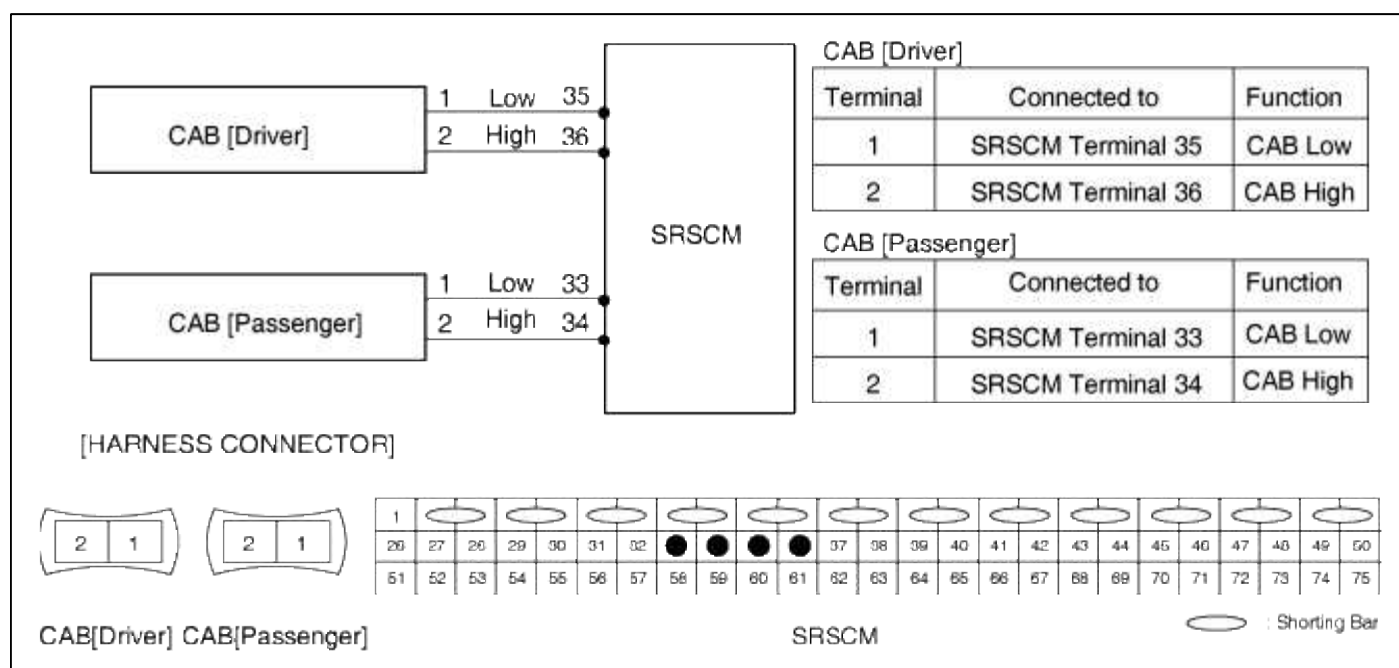
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	<ul style="list-style-type: none"> <li>Too high or low resistance between CAB high(+) and CAB low(-)</li> <li>Curtain Airbag (CAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Curtain Airbag (CAB) squib</li> <li>SRSCM</li> </ul>

#### Specification

CAB resistance : 1.4 ~ 4.5  $\Omega$

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK CAB RESISTANCE

#### CAUTION

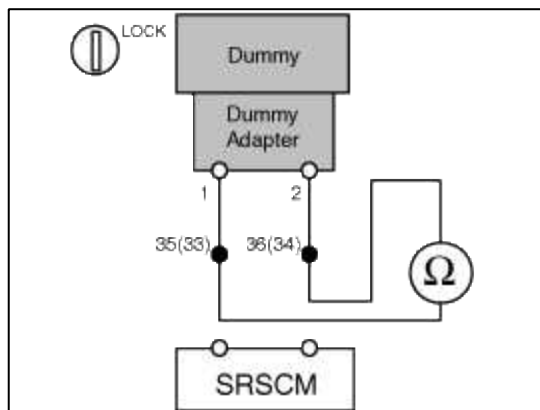
Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

(1) Connect the Dummy and the Dummy Adapter on CAB harness connector.

- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

- (2) Measure resistance between the terminal 35(33) and 36(34) of SRSCM harness connector(B).

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Curtain Airbag(CAB) module.

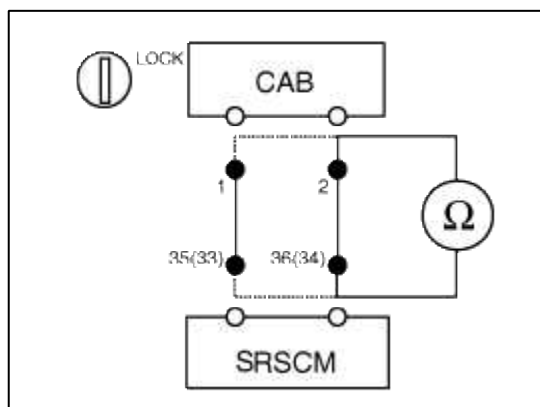
**NO**

Check open circuit.

### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 36(34) of SRSCM harness connector(B).
- (2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 35(33) of SRSCM harness connector(B).

Specification (resistance) : below 1  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Check short circuit.

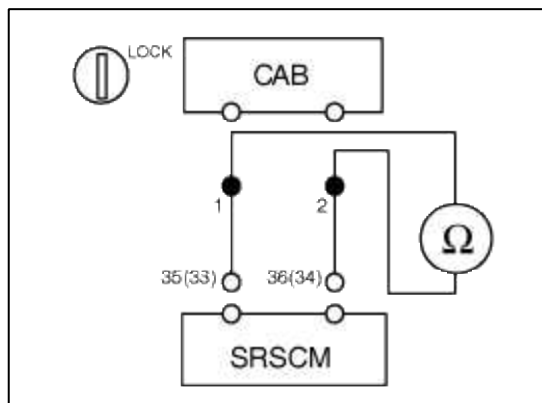
**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

#### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1475 Inflatable Curtain Airbag Front-Driver Resistance Circuit Short to Ground

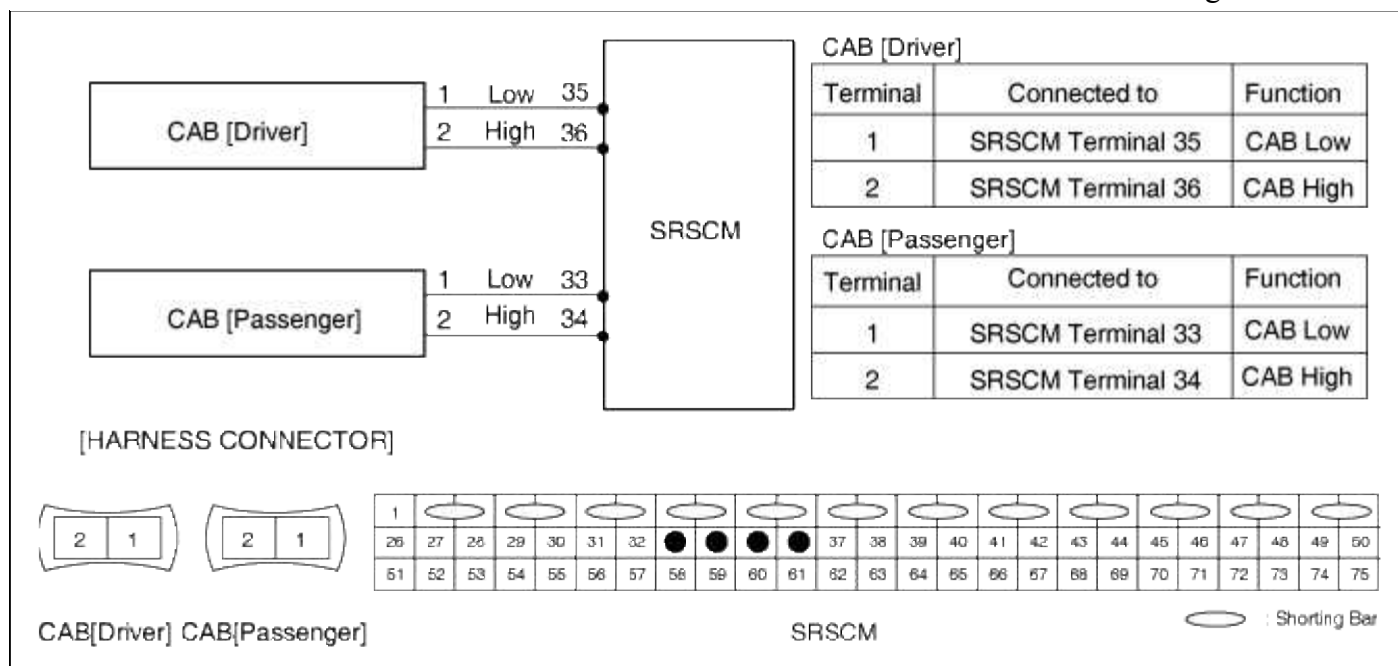
#### DTC Description

The CAB squib circuit consists of the SRSCM and two Curtain Airbags (CAB). It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when short to ground is detected in the CAB squib circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1475 B1479	<ul style="list-style-type: none"> <li>Short to ground between CAB and SRSCM</li> <li>Curtain Airbag (CAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Short to ground circuit on wiring harness</li> <li>Curtain Airbag (CAB) squib</li> <li>SRSCM</li> </ul>

#### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

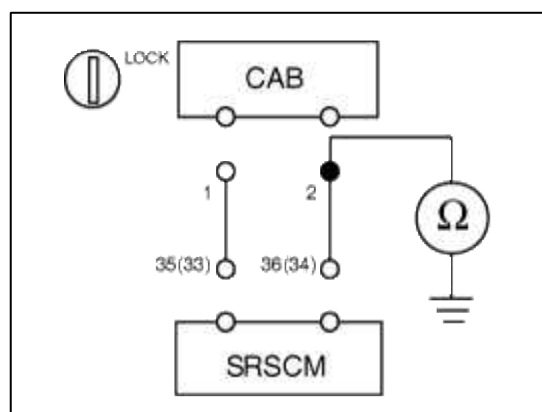
#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 2 of CAB harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the CAB Module.

**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

### 3. CHECK THE CAB MODULE

- (1) Replace the Curtain Airbag(CAB) with a new one.
  - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

**YES**

Go to next step.

**NO**

Replace CAB module.

### 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section

#### **Restraint > Troubleshooting > B1476 Inflatable Curtain Airbag Front-Driver Resistance Circuit Short to Battery**

##### DTC Description

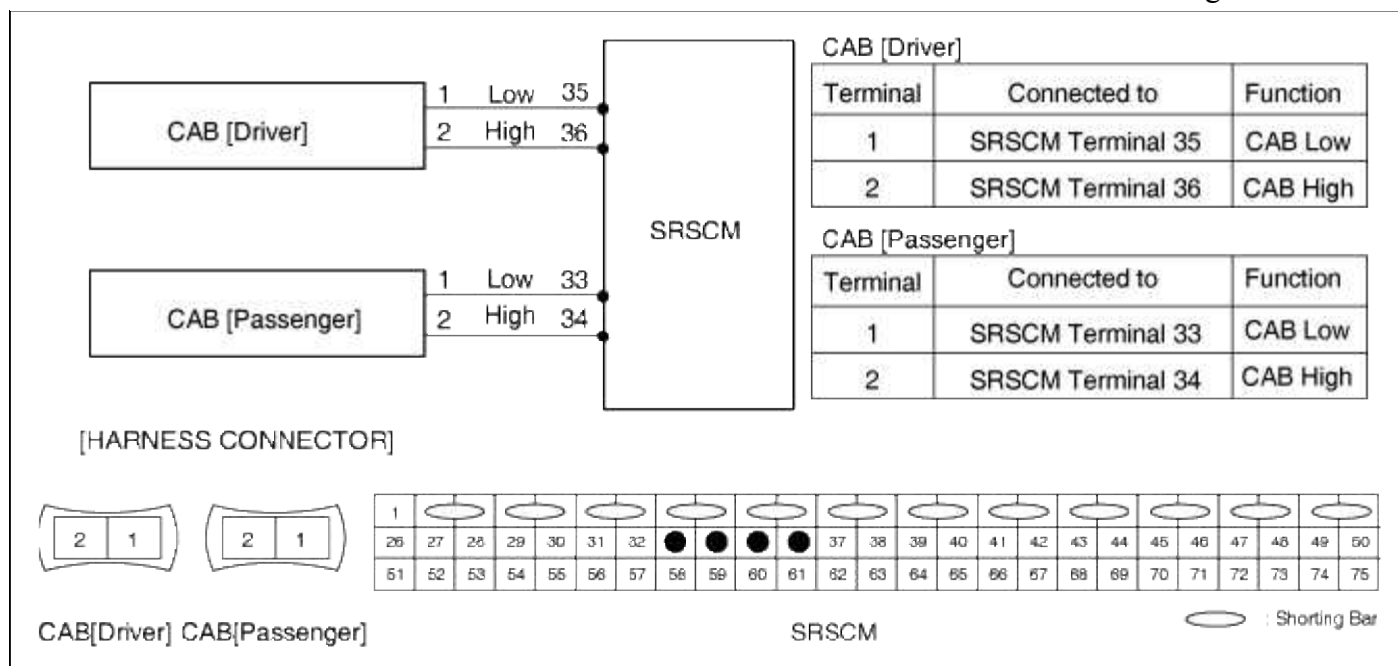
The CAB squib circuit consists of the SRSCM and CAB. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when short to battery is detected in the CAB squib circuit.

##### DTC Detecting Condition

DTC	Condition	Probable cause
B1476 B1480	<ul style="list-style-type: none"> <li>• Short to battery between CAB and SRSCM</li> <li>• Curtain Airbag (CAB) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to battery line circuit on wiring harness</li> <li>• Curtain Airbag (CAB) squib</li> <li>• SRSCM</li> </ul>

##### Schematic Diagram





### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

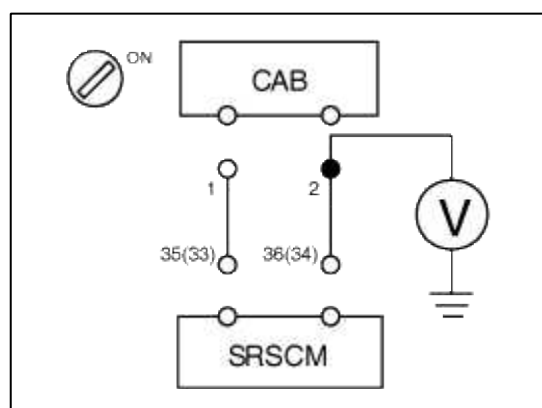
#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2 of CAB harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



- (4) Is the measured voltage within specification?

**YES**

Check the CAB Module.

**NO**

Repair the short to battery line circuit on wiring harness between the CAB and the SRSCM.

### 3. CHECK THE CAB MODULE

- (1) Replace the Curtain Airbag(CAB) with a new one.
  - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

**YES**

Go to next step.

**NO**

Replace CAB module.

### 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B1477 Inflatable Curtain Airbag Front-Passenger Resistance too High

##### DTC Description

The CAB squib circuit consists of the SRSCM and two Curtain Airbags(CAB). It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

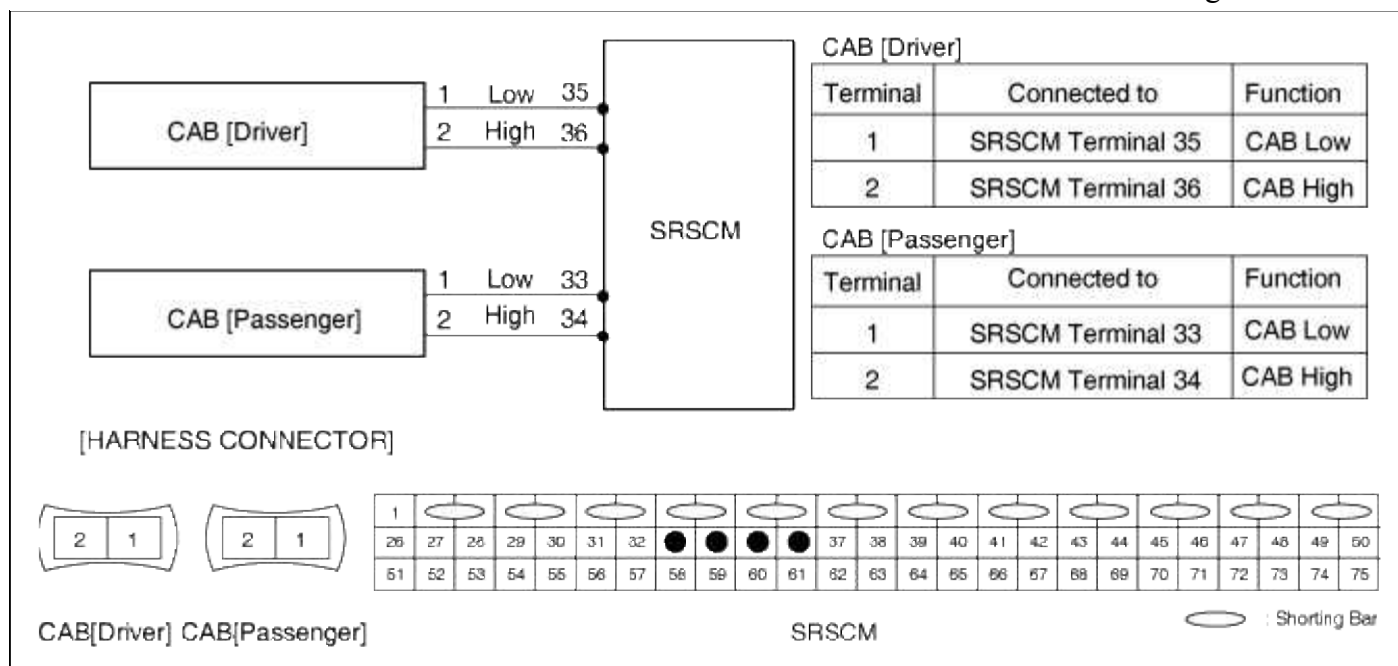
##### DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	<ul style="list-style-type: none"> <li>• Too high or low resistance between CAB high(+) and CAB low(-)</li> <li>• Curtain Airbag (CAB) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short circuit on wiring harness</li> <li>• Curtain Airbag (CAB) squib</li> <li>• SRSCM</li> </ul>

##### Specification

CAB resistance : 1.4 ~ 4.5  $\Omega$

##### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

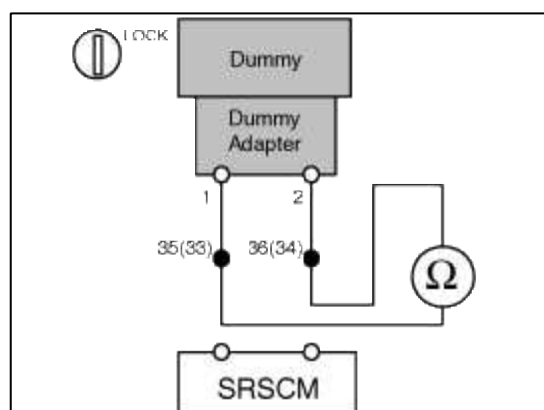
#### 2. CHECK CAB RESISTANCE

##### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 35(33) and 36(34) of SRSCM harness connector(B).

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Replace the Curtain Airbag(CAB) module.

**NO**

Check open circuit.

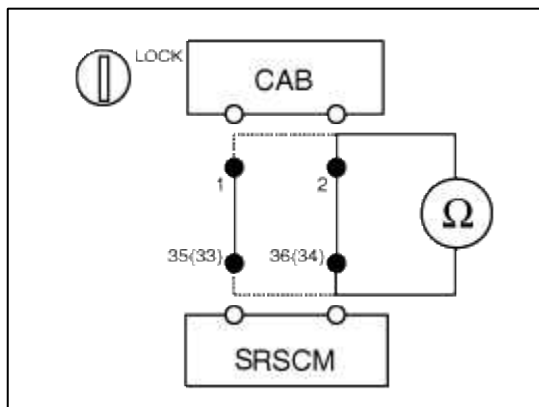
### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 36(34) of SRSCM harness connector(B).
- (2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 35(33) of SRSCM harness connector(B).

---

Specification (resistance) : below 1  $\Omega$

---



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

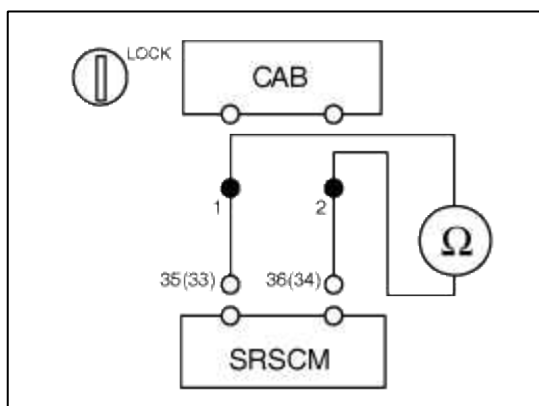
### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

---

Specification (resistance) : infinite

---



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

## 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1478 Inflatable Curtain Airbag Front-Passenger Resistance too Low

#### DTC Description

The CAB squib circuit consists of the SRSCM and two Curtain Airbags(CAB). It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

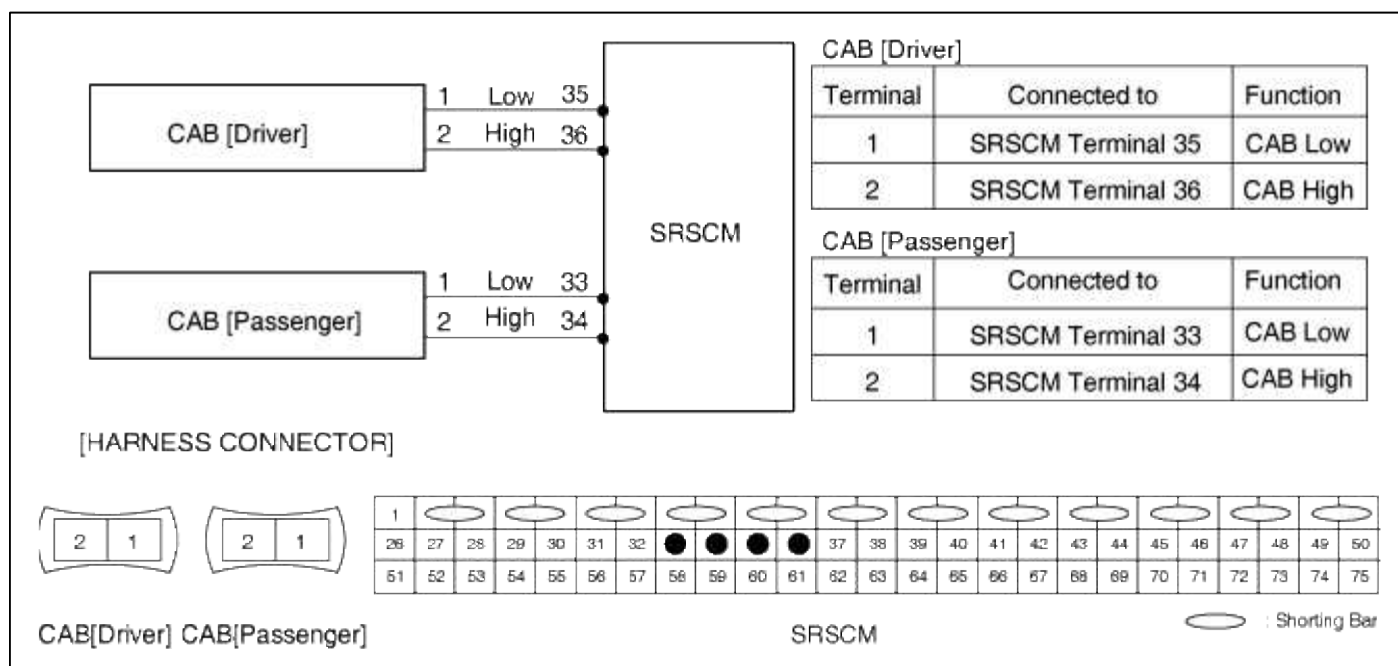
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	<ul style="list-style-type: none"> <li>Too high or low resistance between CAB high(+) and CAB low(-)</li> <li>Curtain Airbag (CAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Curtain Airbag (CAB) squib</li> <li>SRSCM</li> </ul>

#### Specification

CAB resistance : 1.4 ~ 4.5  $\Omega$

#### Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

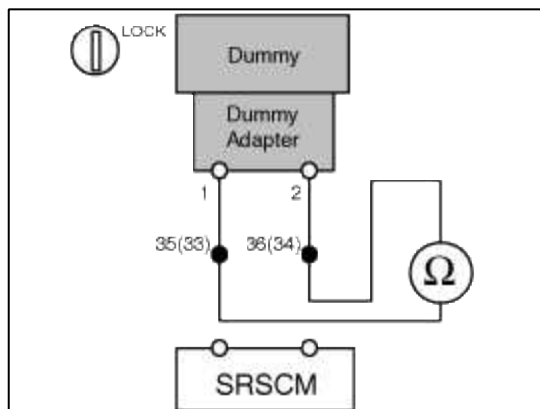
## 2. CHECK CAB RESISTANCE

**CAUTION**

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 35(33) and 36(34) of SRSCM harness connector(B).

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Curtain Airbag(CAB) module.

**NO**

Check open circuit.

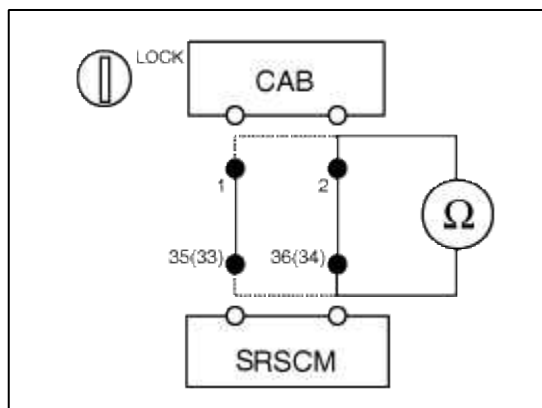
### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 36(34) of SRSCM harness connector(B).
- (2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 35(33) of SRSCM harness connector(B).

---

Specification (resistance) : below 1  $\Omega$

---



- (3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

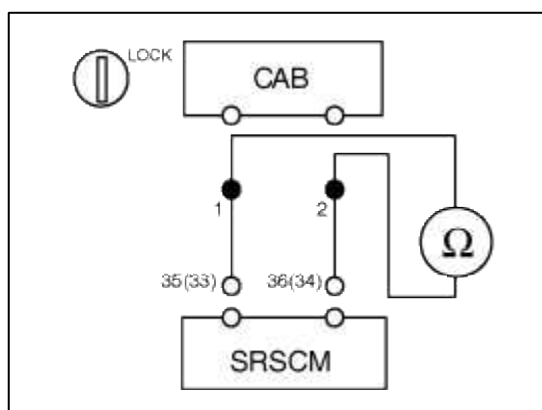
### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

---

Specification (resistance) : infinite

---



- (2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Restraint > Troubleshooting > B1479 Inflatable Curtain Airbag Front-Passenger Resistance Circuit Short to Ground

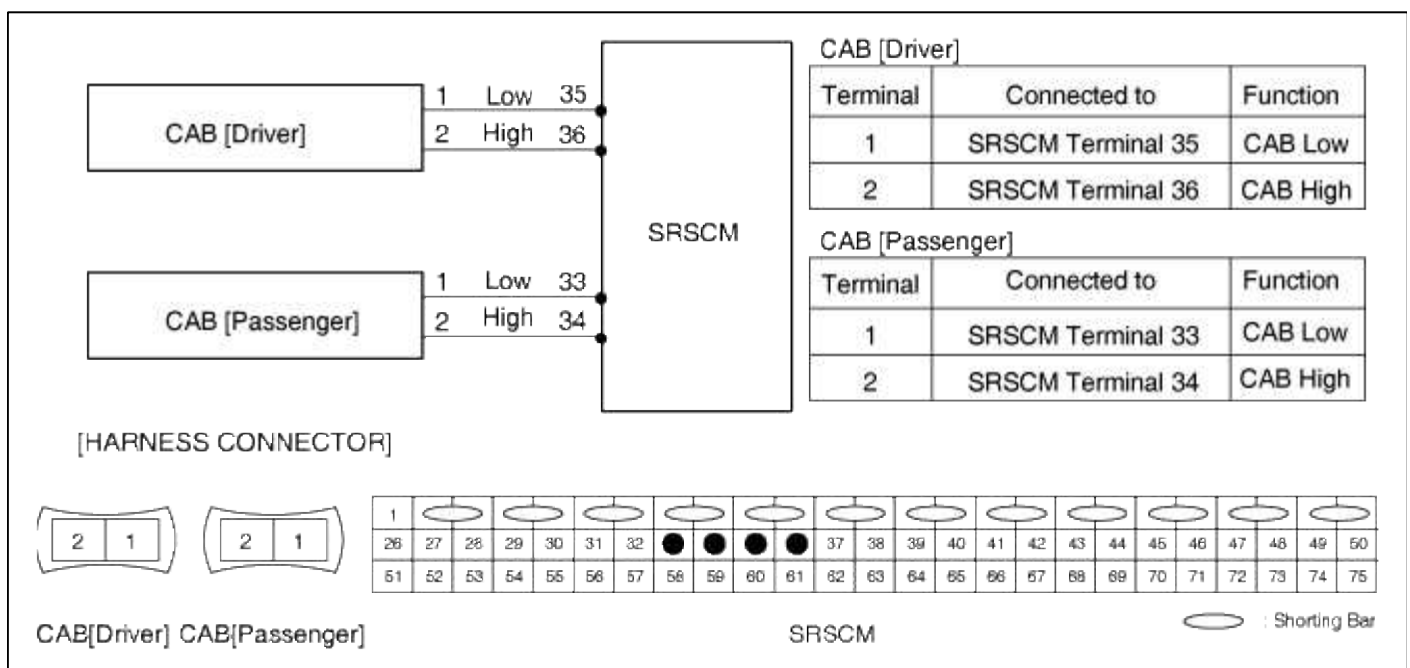
### DTC Description

The CAB squib circuit consists of the SRSCM and two Curtain Airbags (CAB). It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when short to ground is detected in the CAB squib circuit.

### DTC Detecting Condition

DTC	Condition	Probable cause
B1475 B1479	<ul style="list-style-type: none"> <li>• Short to ground between CAB and SRSCM</li> <li>• Curtain Airbag (CAB) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to ground circuit on wiring harness</li> <li>• Curtain Airbag (CAB) squib</li> <li>• SRSCM</li> </ul>

### Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

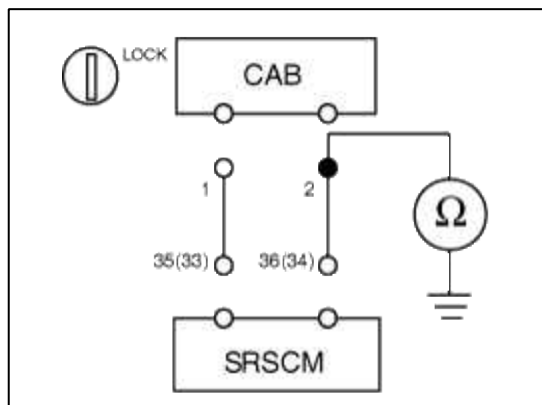
Refer to the DESCRIPTION in this TROUBLESHOOTING section.



## 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 2 of CAB harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the CAB Module.

**NO**

Repair or replace the wiring harness between the CAB and the SRSCM.

## 3. CHECK THE CAB MODULE

- (1) Replace the Curtain Airbag(CAB) with a new one.
  - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

**YES**

Go to next step.

**NO**

Replace CAB module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section

### Restraint > Troubleshooting > B1480 Inflatable Curtain Airbag Front-Passenger Resistance Circuit Short to Battery

#### DTC Description

The CAB squib circuit consists of the SRSCM and CAB. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when short to battery is detected in the CAB squib circuit.

#### DTC Detecting Condition



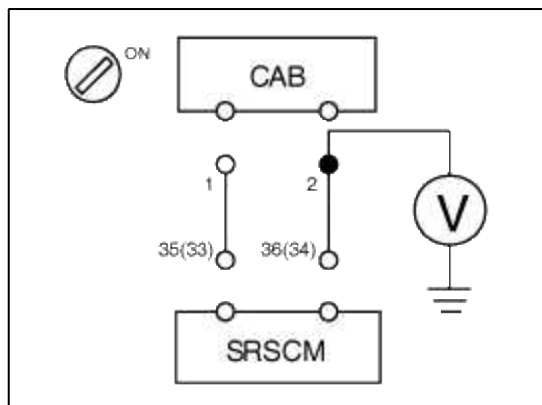
## 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2 of CAB harness connector and chassis ground.

---

Specification (voltage) : Approximately 0 V

---



- (4) Is the measured voltage within specification?

**YES**

Check the CAB Module.

**NO**

Repair the short to battery line circuit on wiring harness between the CAB and the SRSCM.

## 3. CHECK THE CAB MODULE

- (1) Replace the Curtain Airbag(CAB) with a new one.
  - Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

**YES**

Go to next step.

**NO**

Replace CAB module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1481 Driver Airbag Resistance too High(2nd stage)

#### DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

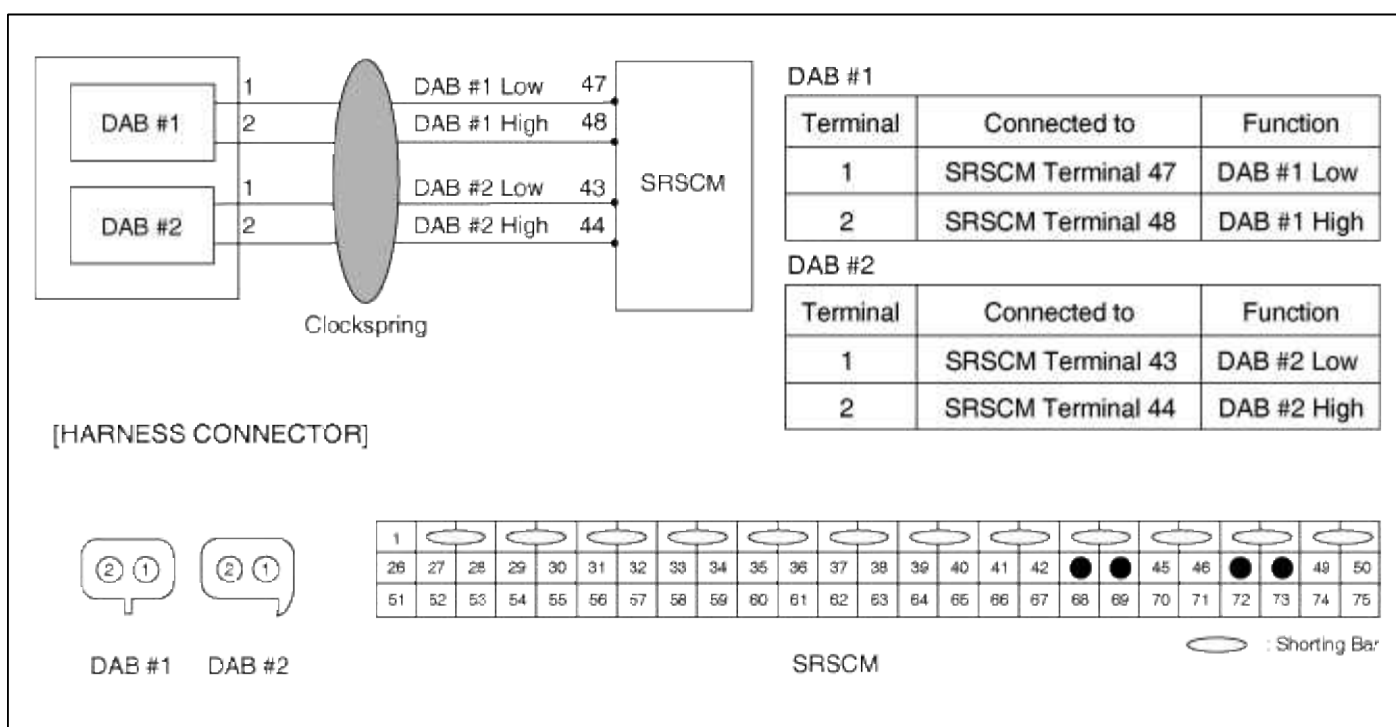
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1481 B1482	<ul style="list-style-type: none"> <li>Too high or low resistance between DAB high(+) and DAB low (-)</li> <li>Driver Airbag (DAB) Malfunction</li> <li>Clockspring Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Driver Airbag (DAB) squib</li> <li>Clockspring</li> <li>SRSCM</li> </ul>

### Specification

DAB resistance : 1.4 ~ 6.0  $\Omega$

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

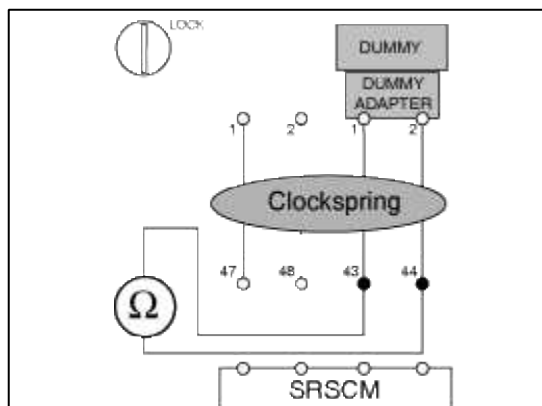
## 2. CHECK DAB RESISTANCE

### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 43 and 44 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 6.0  $\Omega$



- (3) Is the measured resistance within specification?

**NO**

Check open circuit.

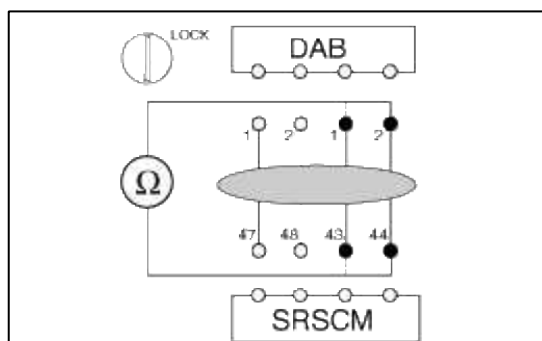
**YES**

Replace the Driver Airbag(DAB) module.

## 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of DAB harness connector and the terminal 44 of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of DAB harness connector and the terminal 43 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

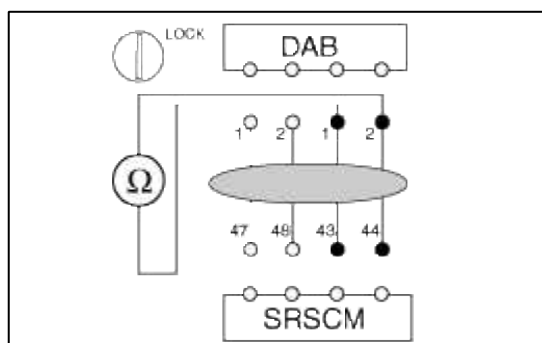
**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

#### 4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of DAB harness connector.

Specification (resistance) :  $\infty \Omega$



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B1482 Driver Airbag Resistance too Low(2nd stage)

##### DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

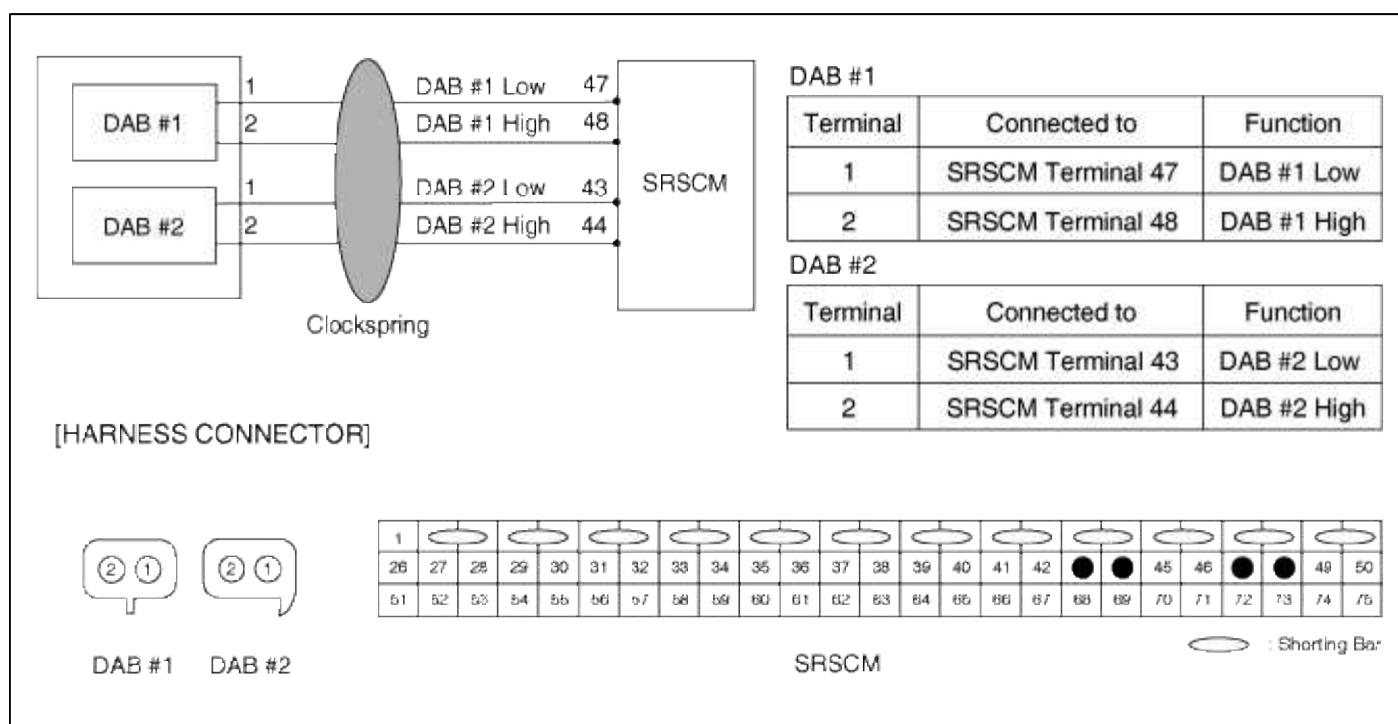
##### DTC Detecting Condition

DTC	Condition	Probable cause
B1481 B1482	<ul style="list-style-type: none"> <li>Too high or low resistance between DAB high(+) and DAB low (-)</li> <li>Driver Airbag (DAB) Malfunction</li> <li>Clockspring Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Driver Airbag (DAB) squib</li> <li>Clockspring</li> <li>SRSCM</li> </ul>

##### Specification

DAB resistance : 1.4 ~ 6.0  $\Omega$

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### 2. CHECK DAB RESISTANCE

#### CAUTION

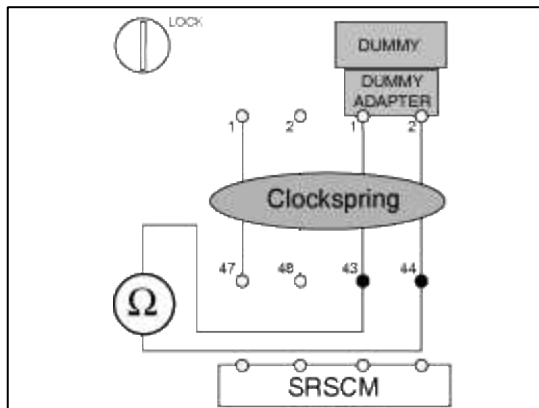
Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

(1) Connect the Dummy and the Dummy Adapter on DAB harness connector.

- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

- (2) Measure resistance between the terminal 43 and 44 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 6.0  $\Omega$



- (3) Is the measured resistance within specification?

**NO**

Check open circuit.

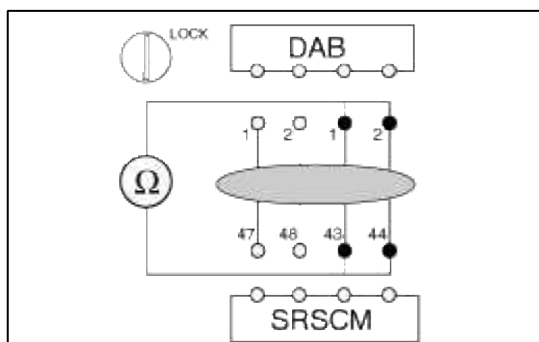
**YES**

Replace the Driver Airbag(DAB) module.

### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of DAB harness connector and the terminal 44 of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of DAB harness connector and the terminal 43 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

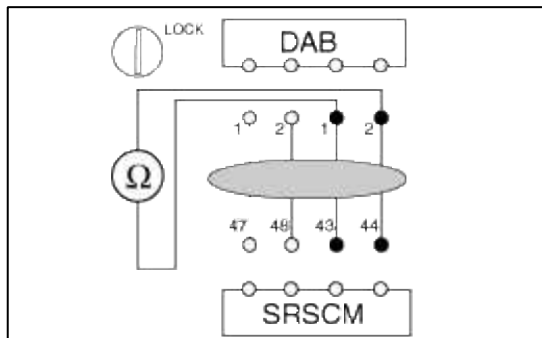
Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.



#### 4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of DAB harness connector.

Specification (resistance) :  $\infty \Omega$



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B1483 Driver Airbag Resistance Circuit Short to Ground(2nd stage)

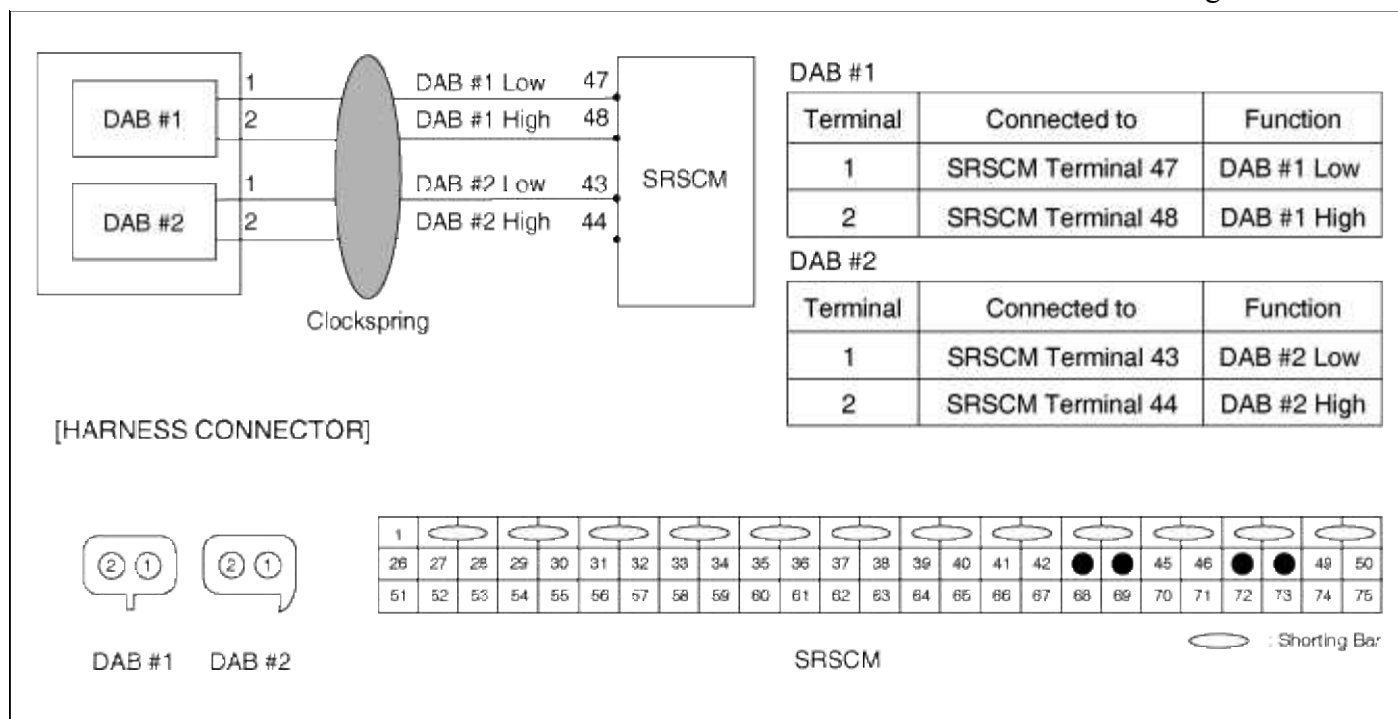
##### DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

##### DTC Detecting Condition

DTC	Condition	Probable cause
B1348 B1483	<ul style="list-style-type: none"> <li>• Short to ground between DAB and clockspring</li> <li>• Short to ground between clockspring and SRSCM</li> <li>• Driver Airbag (DAB) Malfunction</li> <li>• Clockspring Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to ground circuit on wiring harness</li> <li>• Driver Airbag (DAB) squib</li> <li>• Clockspring</li> <li>• SRSCM</li> </ul>

##### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

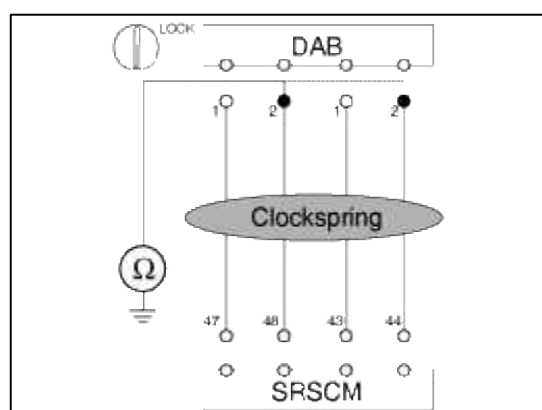
#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 2 of DAB harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the DAB Module.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

### 3. CHECK THE DAB MODULE

- (1) Replace the Driver Airbag(DAB) with a new one.
  - Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to DAB?

**YES**

Check the clockspring.

**NO**

Replace the Driver Airbag(DAB).

### 4. CHECK THE CLOCKSPrING

- (1) Check the clockspring.
- Is the clockspring normal?

**YES**

Go to next step.

**NO**

Replace the clockspring.

### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B1484 Driver Airbag Resistance Circuit Short to Battery(2nd stage)

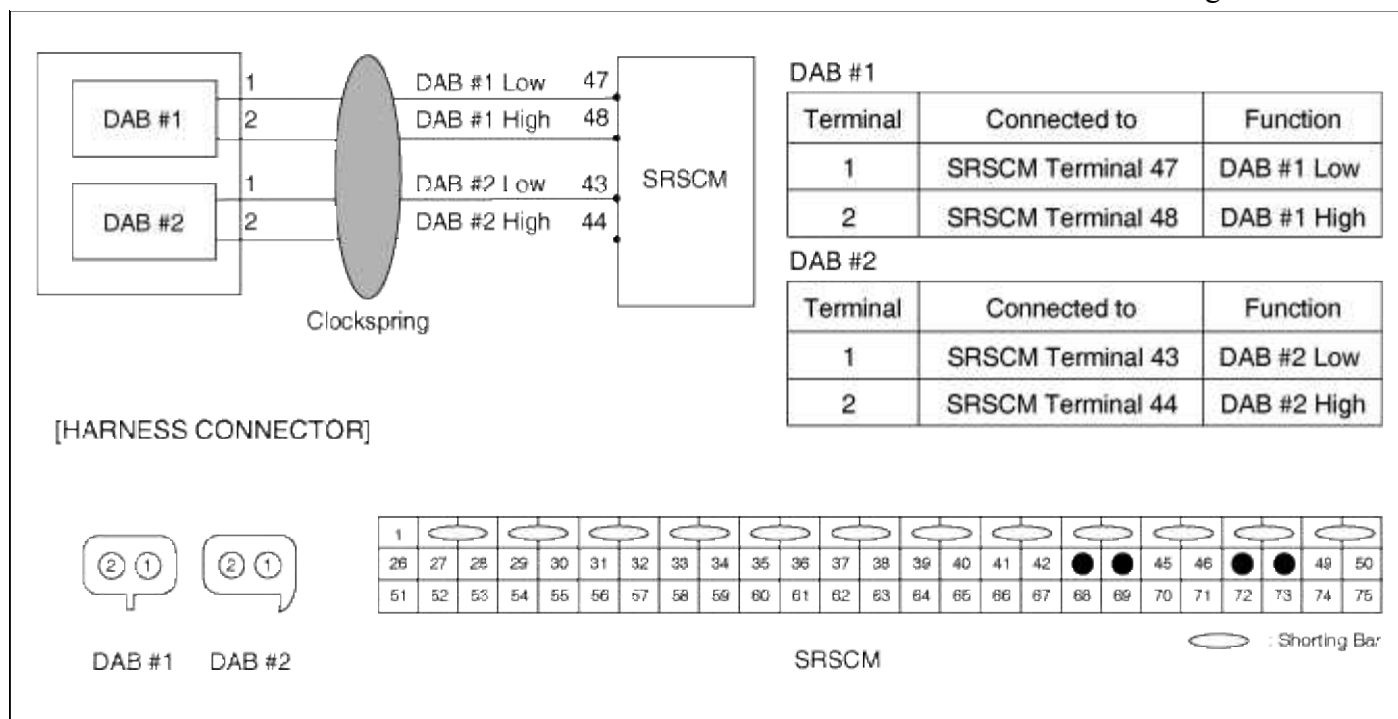
#### DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1349 B1484	<ul style="list-style-type: none"> <li>• Short to battery line between DAB and clockspring</li> <li>• Short to battery line between clockspring and SRSCM</li> <li>• Driver Airbag (DAB) Malfunction</li> <li>• Clockspring Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to battery line on wiring harness</li> <li>• Driver Airbag (DAB) squib</li> <li>• Clockspring</li> <li>• SRSCM</li> </ul>

#### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

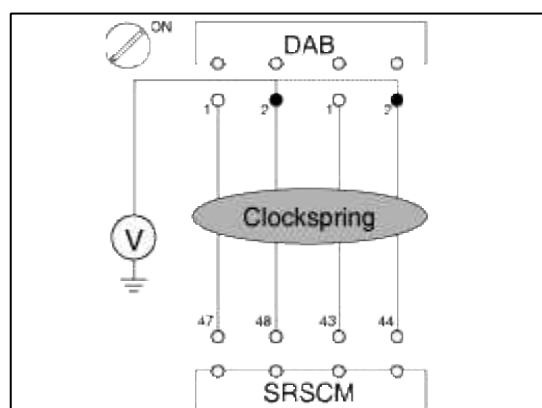
#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2 of DAB harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

**YES**

Check the DAB module.

**NO**

Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

### 3. CHECK THE DAB MODULE

(1) Replace the Driver Airbag(DAB) with a new one.

- Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

(2) Install the DAB module and connect the DAB connector.

(3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the battery negative cable to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to DAB?

**YES**

Check the clockspring.

**NO**

Replace the Driver Airbag(DAB).

### 4. CHECK THE CLOCKSPRING

(1) Check the clockspring.

Is the clockspring normal?

**YES**

Go to next step.

**NO**

Replace the clockspring.

### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Restraint > Troubleshooting > B1485 Passenger Airbag Resistance too High(2nd stage)

### DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

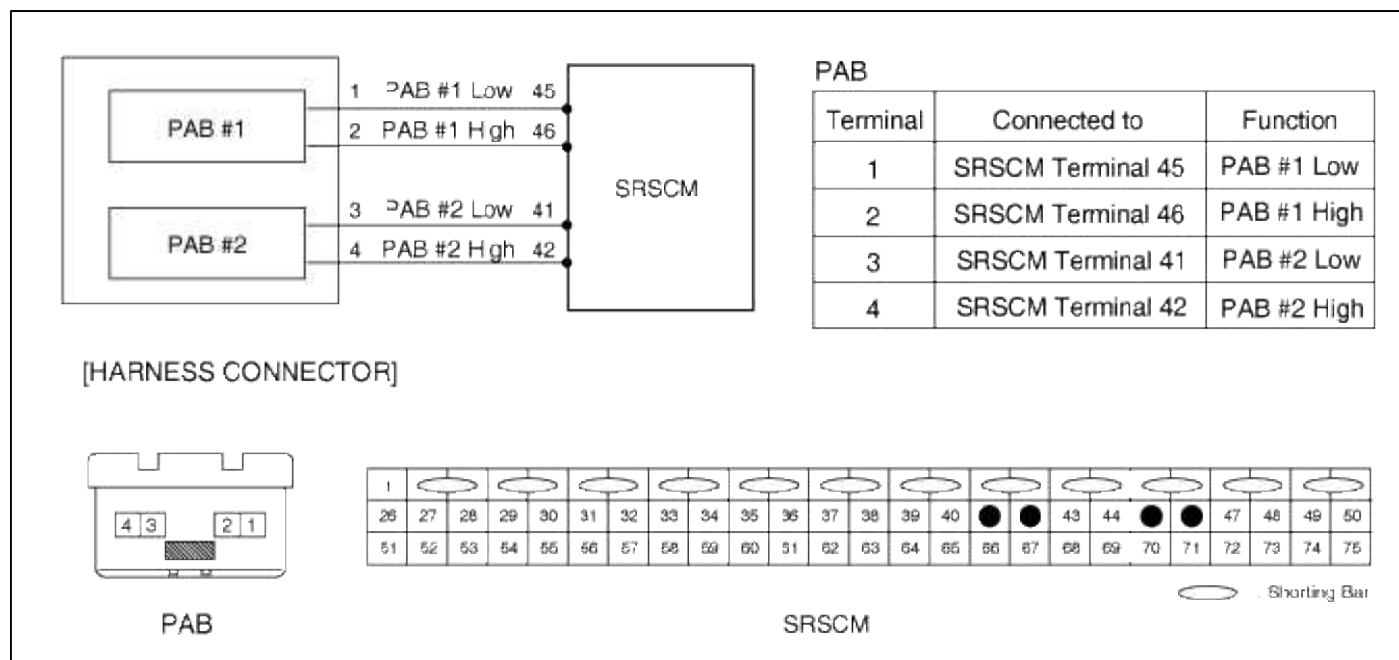
### DTC Detecting Condition

DTC	Condition	Probable cause
B1485 B1486	<ul style="list-style-type: none"> <li>• Too high or low resistance between PAB high(+) and PAB low (-)</li> <li>• Passenger Airbag (PAB) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short circuit on wiring harness</li> <li>• Passenger Airbag (PAB) squib</li> <li>• SRSCM</li> </ul>

## Specification

PAB resistance : 1.4 ~ 6.0  $\Omega$

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### 2. CHECK PAB RESISTANCE

#### CAUTION

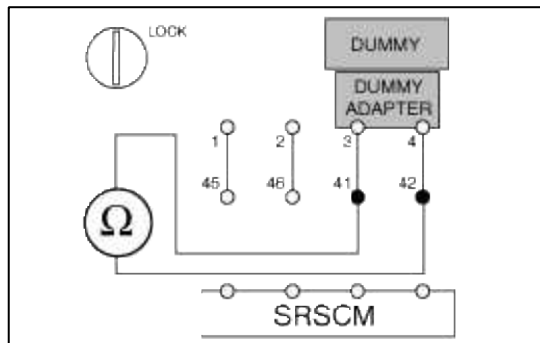
Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

(1) Connect the Dummy and the Dummy Adapter on PAB harness connector.

- Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

- (2) Measure resistance between the terminal 41 and 42 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 6.0  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Passenger Airbag(PAB) module.

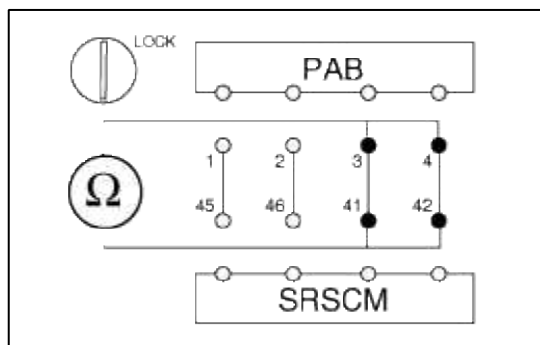
**NO**

Check open circuit.

### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 4 of PAB harness connector and the terminal 42 of SRSCM harness connector.
- (2) Measure resistance between the terminal 3 of PAB harness connector and the terminal 41 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Check short circuit.

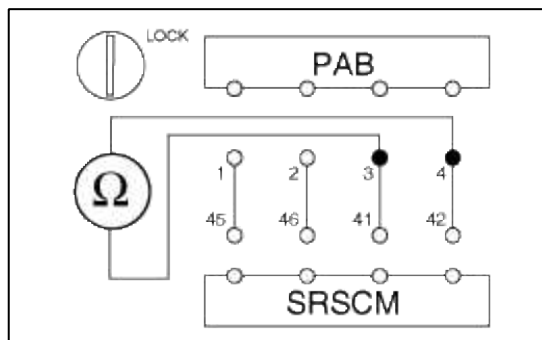
**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

#### 4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 3 and 4 of PAB harness connector.

Specification (resistance) : infinite



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B1486 Passenger Airbag Resistance too Low(2nd stage)

##### DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

##### DTC Detecting Condition

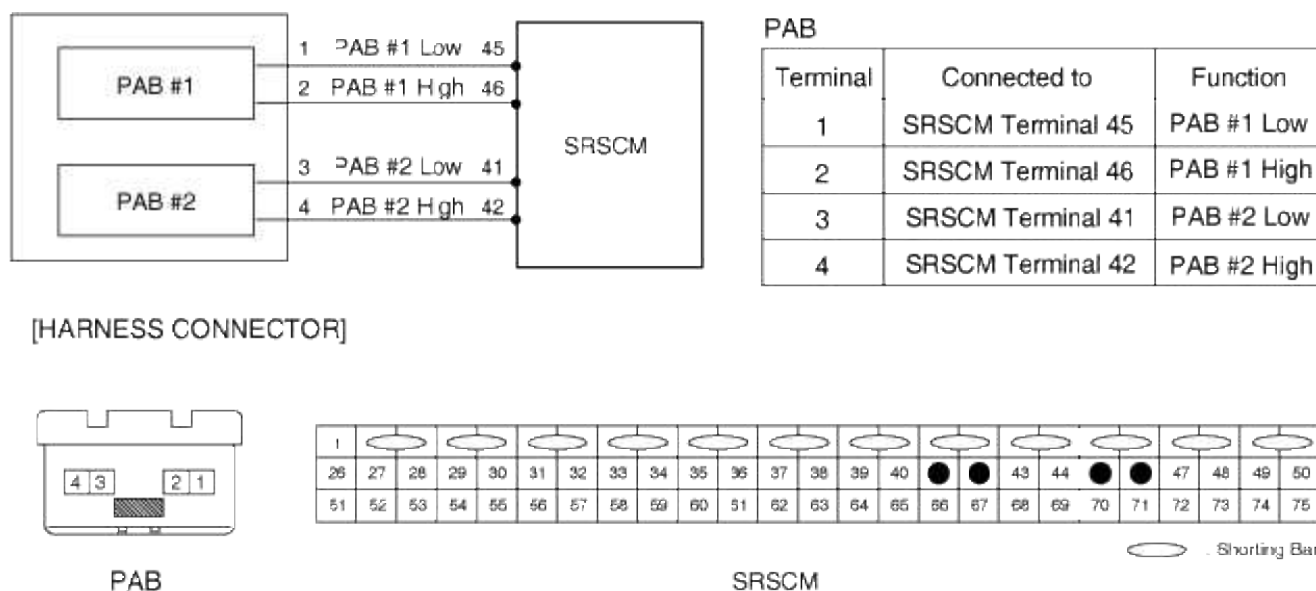
DTC	Condition	Probable cause
B1485 B1486	<ul style="list-style-type: none"> <li>Too high or low resistance between PAB high(+) and PAB low (-)</li> <li>Passenger Airbag (PAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Passenger Airbag (PAB) squib</li> <li>SRSCM</li> </ul>

##### Specification

PAB resistance : 1.4 ~ 6.0 Ω

##### Schematic Diagram





## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

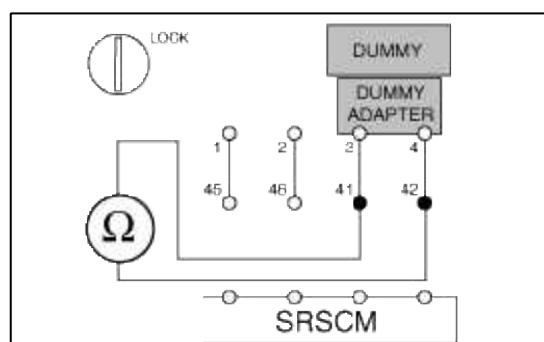
#### 2. CHECK PAB RESISTANCE

#### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 41 and 42 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 6.0  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Replace the Passenger Airbag(PAB) module.

**NO**

Check open circuit.

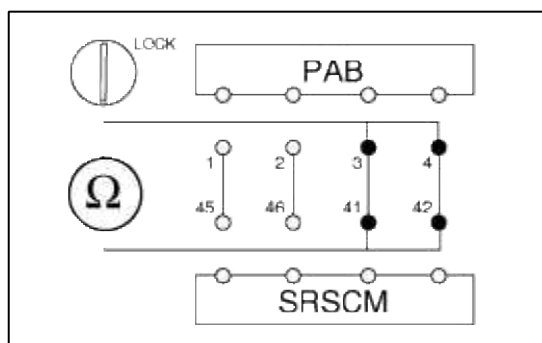
### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 4 of PAB harness connector and the terminal 42 of SRSCM harness connector.
- (2) Measure resistance between the terminal 3 of PAB harness connector and the terminal 41 of SRSCM harness connector.

---

Specification (resistance) : below 1  $\Omega$

---



(3) Is the measured resistance within specification?

**YES**

Check short circuit.

**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

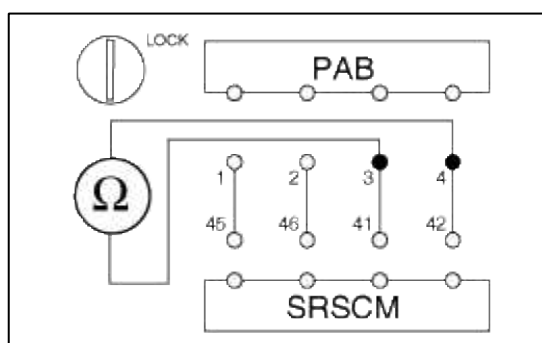
### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 3 and 4 of PAB harness connector.

---

Specification (resistance) : infinite

---



(2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

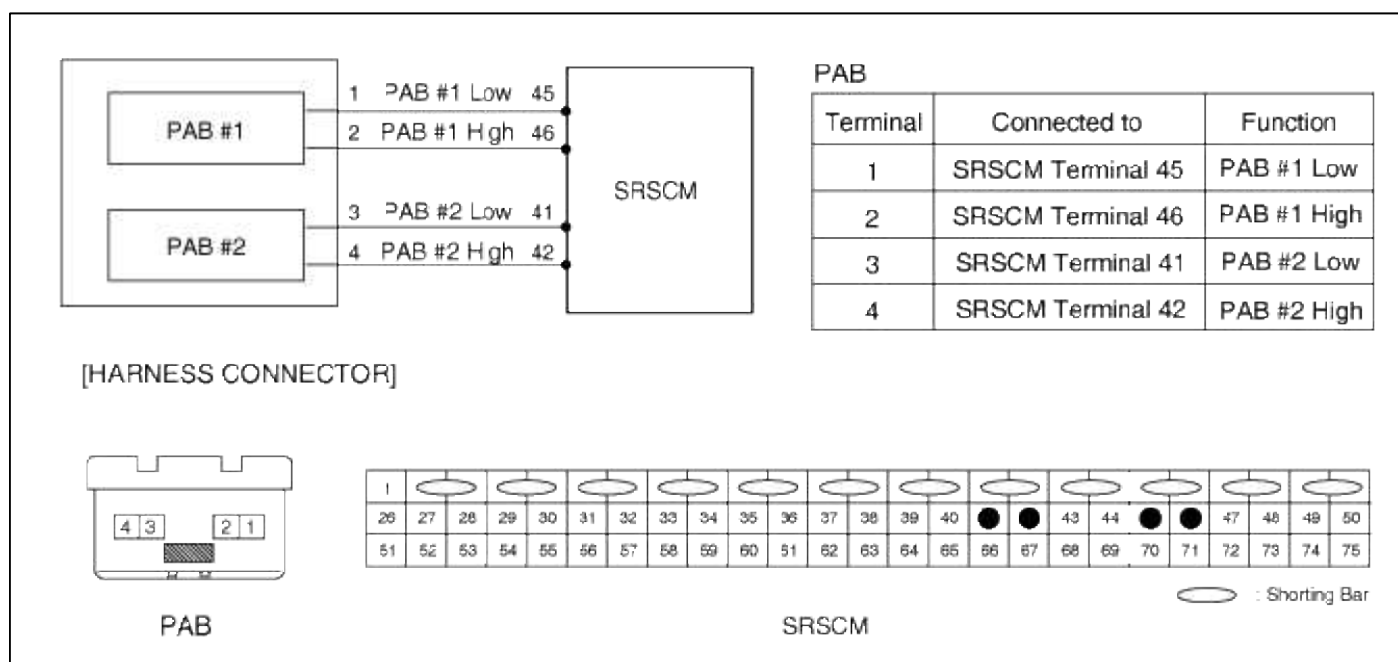
Refer to the DESCRIPTION in this TROUBLESHOOTING section.

**Restraint > Troubleshooting > B1487 Passenger Airbag Resistance Circuit Short to Ground(2nd stage)****DTC Description**

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

**DTC Detecting Condition**

DTC	Condition	Probable cause
B1354 B1487	<ul style="list-style-type: none"> <li>• Short to ground between PAB module and SRSCM</li> <li>• Passenger Airbag (PAB) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to ground on wiring harness</li> <li>• Passenger Airbag (PAB) squib</li> <li>• SRSCM</li> </ul>

**Schematic Diagram****Terminal & Connector Inspection**

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

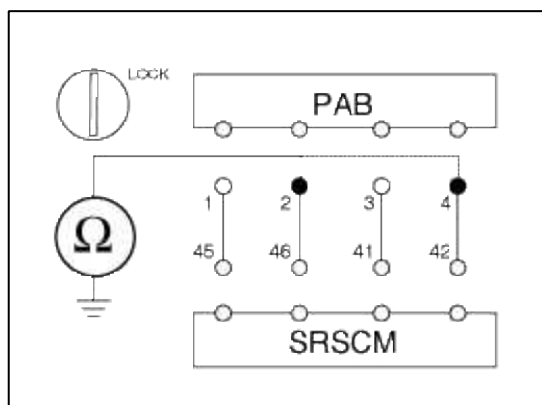
**Inspection Procedure****1. PREPARATION**

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 2(4) of PAB harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the PAB Module.

**NO**

Repair or replace the wiring harness between the PAB and the SRSCM.

## 3. CHECK THE PAB MODULE

- (1) Replace the Passenger Airbag (PAB) with a new one.
    - Refer to "Passenger Airbag (PAB)" section in this SERVICE MANUAL.
  - (2) Install the DAB module and connect the DAB connector.
  - (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
  - (4) Connect the SRSCM connector.
  - (5) Connect the battery negative cable to the battery.
  - (6) Connect a Hi-Scan(Pro) to the data link connector.
  - (7) Turn the ignition switch to ON and check the vehicle again.
- Does Hi-Scan (Pro) indicate any DTC related to PAB?

**YES**

Go to next step.

**NO**

Replace PAB module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1488 Passenger Airbag Resistance Circuit Short to Battery(2nd stage)

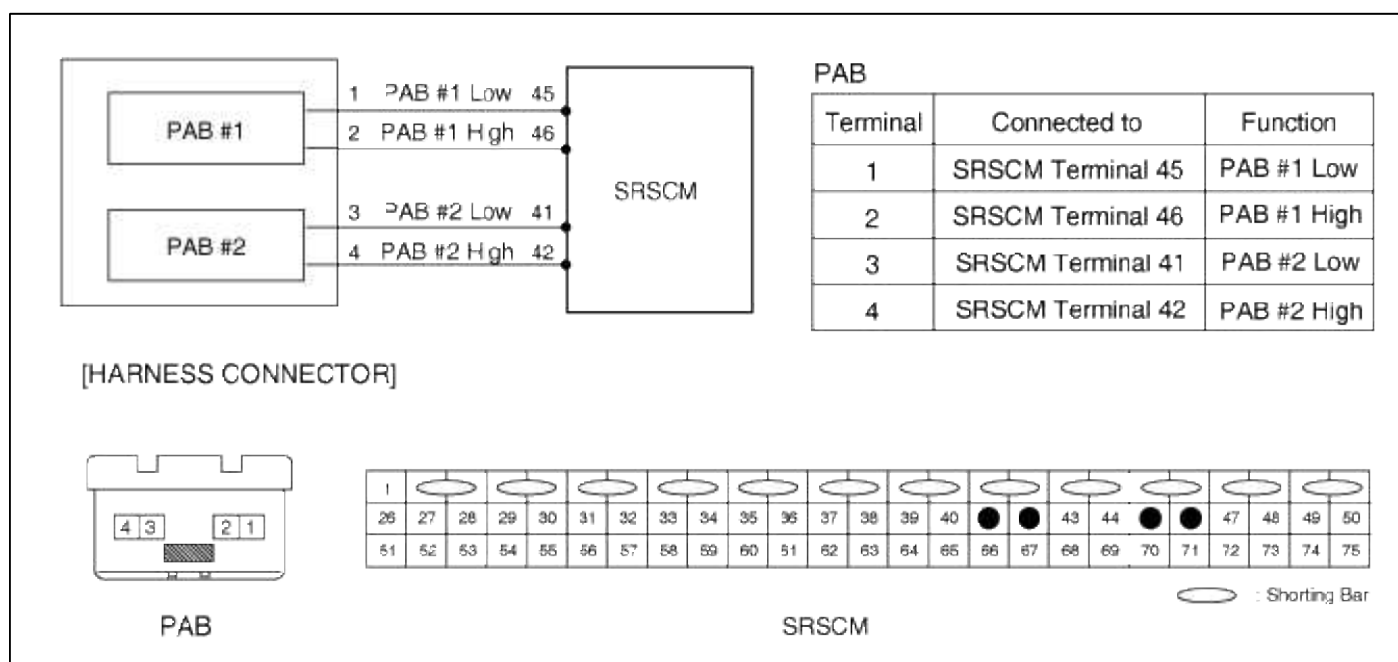
#### DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1355 B1488	<ul style="list-style-type: none"> <li>Short to battery line between PAB and SRSCM</li> <li>Passenger Airbag (PAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Short to battery line circuit on wiring harness</li> <li>Passenger Airbag (PAB) squib</li> <li>SRSCM</li> </ul>

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

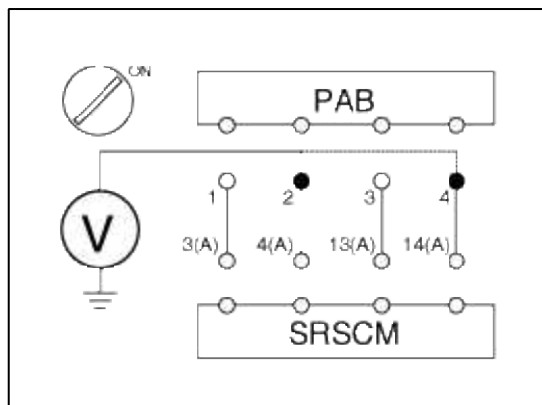
## 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2(4) of PAB harness connector and chassis ground.

---

Specification (voltage) : Approximately 0 V

---



- (4) Is the measured voltage within specification?

**YES**

Check the PAB Module.

**NO**

Repair the short to battery line circuit on wiring harness between the PAB and the SRSCM.

## 3. CHECK THE PAB MODULE

- (1) Replace the Passenger Airbag(PAB) with a new one.
  - Refer to "Passenger Airbag(PAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to PAB?

**YES**

Go to next step.

**NO**

Replace PAB module.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1511 Buckle Switch Driver open or short to Battery

#### DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects open or short to battery line on the BS circuit. This system decides whether the driver or passenger seat belt is buckled or not.

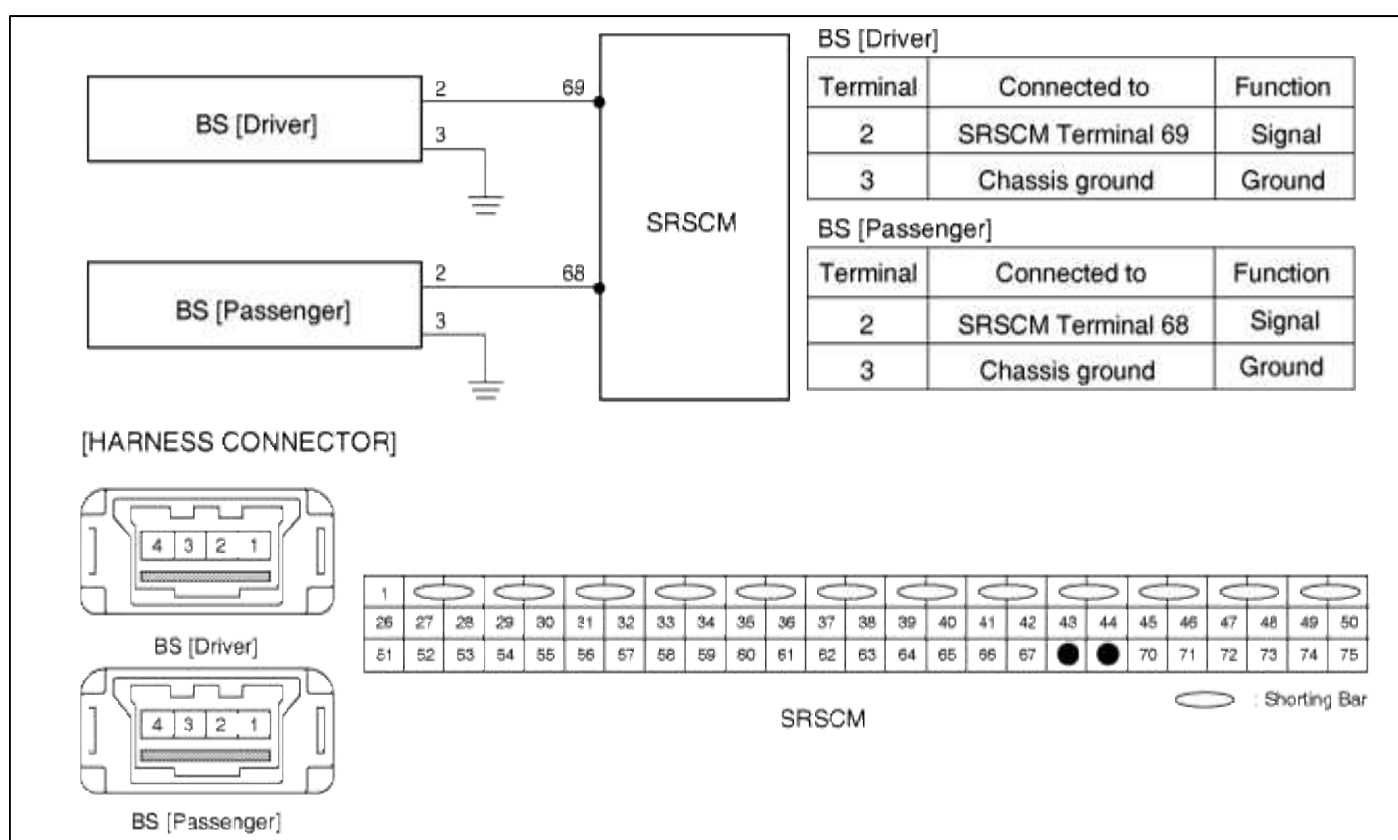
## DTC Detecting Condition

DTC	Condition	Probable cause
B1511 B1513	<ul style="list-style-type: none"> <li>• Open between BS and SRSCM (Current <math>I &lt; 4</math> mA).</li> <li>• Short to battery line between BS and SRSCM (Current <math>I &lt; 4</math> mA)</li> <li>• Seat Belt Buckle Switch (BS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Open or short to battery line circuit on wiring harness</li> <li>• Seat Belt Buckle Switch (BS)</li> <li>• SRSCM</li> </ul>

## Specification

BS Status	Current (mA)	Related DTC
Open or Short to Battery	$I < 4$	B1511, B1513
Unbuckled	$4 \sim 7$	
Defect	$7 \sim 12$	B1515, B1516
Buckled	$12 \sim 17$	
Short or Short to Ground	$I > 17$	B1512, B1514

## Schematic Diagram



## Terminal &amp; Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

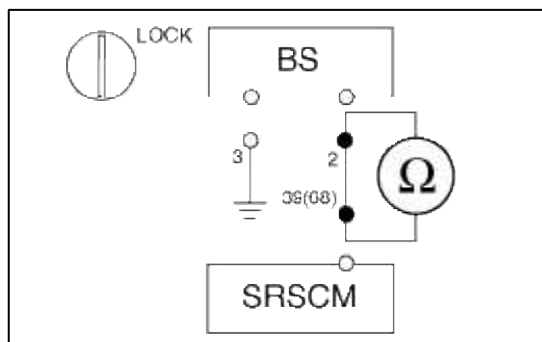
## 2. CHECK OPEN CIRCUIT

- (1) Disconnect the BS connector.
- (2) Measure resistance between the terminal 2 of BS harness connector and the terminal 69(68) of SRSCM harness connector.

---

specification (Resistance) : below 1  $\Omega$

---



- (3) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the BS and the SRSCM.

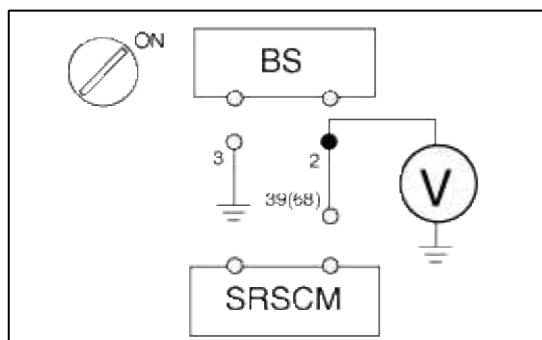
## 3. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 2 of BS harness connector and chassis ground.

---

specification (voltage) : Approximately 0 V

---



- (4) Is the measured voltage within specification?

**YES**

Check the Seat belt buckle switch(BS).

**NO**

Repair the short to battery line circuit on wiring harness between the BS and the SRSCM.



## 4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 2 of BS and 69(68) of SRSCM harness connector.

specification (current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

**YES**

Go to next step.

**NO**

Replace the BS.

## 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

**Restraint > Troubleshooting > B1512 Buckle Switch Driver short or short to Ground**

## DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects short or short to ground on the BS circuit. This system decides whether the driver or passenger seat belt is buckled or not.

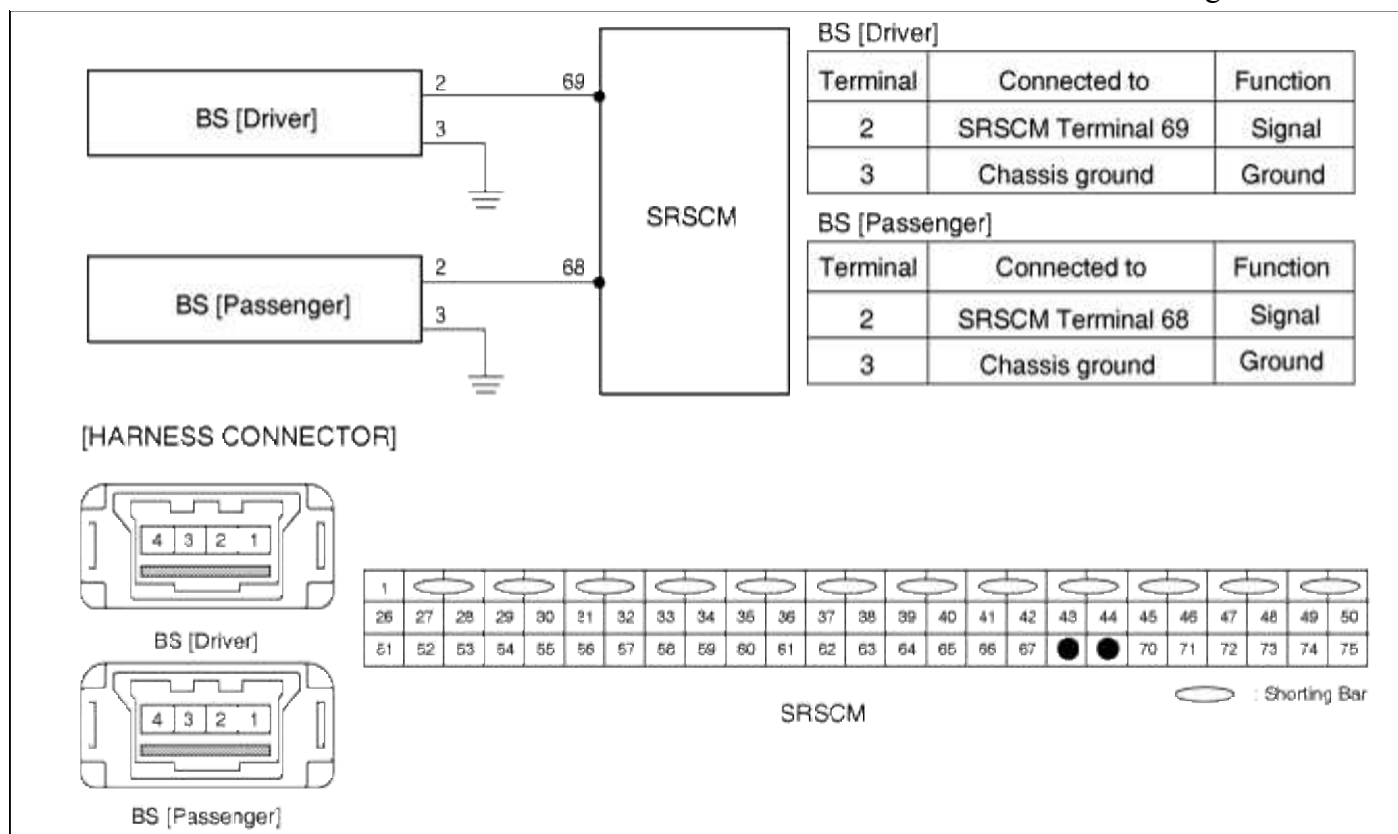
## DTC Detecting Condition

DTC	Condition	Probable cause
B1512 B1514	<ul style="list-style-type: none"> <li>Short or Short to ground between BS and SRSCM (Current <math>I &gt; 17</math> mA)</li> <li>Seat Belt Buckle Switch (BS) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>short or short to ground circuit on wiring harness</li> <li>Seat Belt Buckle Switch (BS)</li> <li>SRSCM</li> </ul>

## Specification

BS Status	Current (mA)	Related DTC
Open or Short to Battery	$I < 4$	B1511, B1513
Unbuckled	4 ~ 7	
Defect	7 ~ 12	B1515, B1516
Buckled	12 ~ 17	
Short or Short to Ground	$I > 17$	B1512, B1514

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

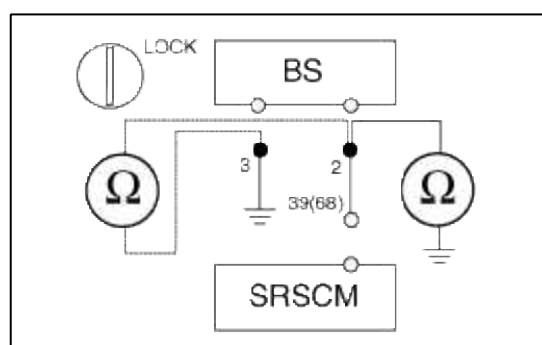
### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### 2. CHECK SHORT OR SHORT TO GROUND

- (1) Disconnect the BS connector.
- (2) Measure resistance between the terminal 2 of BS harness connector and chassis ground.
- (3) Measure resistance between the terminal 2 and 3 of BS harness connector.

specification (Resistance) : Infinite



- (4) Is the measured resistance within specification?

**YES**

(5) Go to next step.

**NO**

Repair the short or short to ground circuit on wiring harness between the BS and the SRSCM.

### 3. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 2 of BS and 69(68) of SRSCM harness connector.

specification (current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

**YES**

Go to next step.

**NO**

Replace the BS.

### 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B1513 Buckle Switch Passenger open or short to Battery

##### DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects open or short to battery line on the BS circuit. This system decides whether the driver or passenger seat belt is buckled or not.

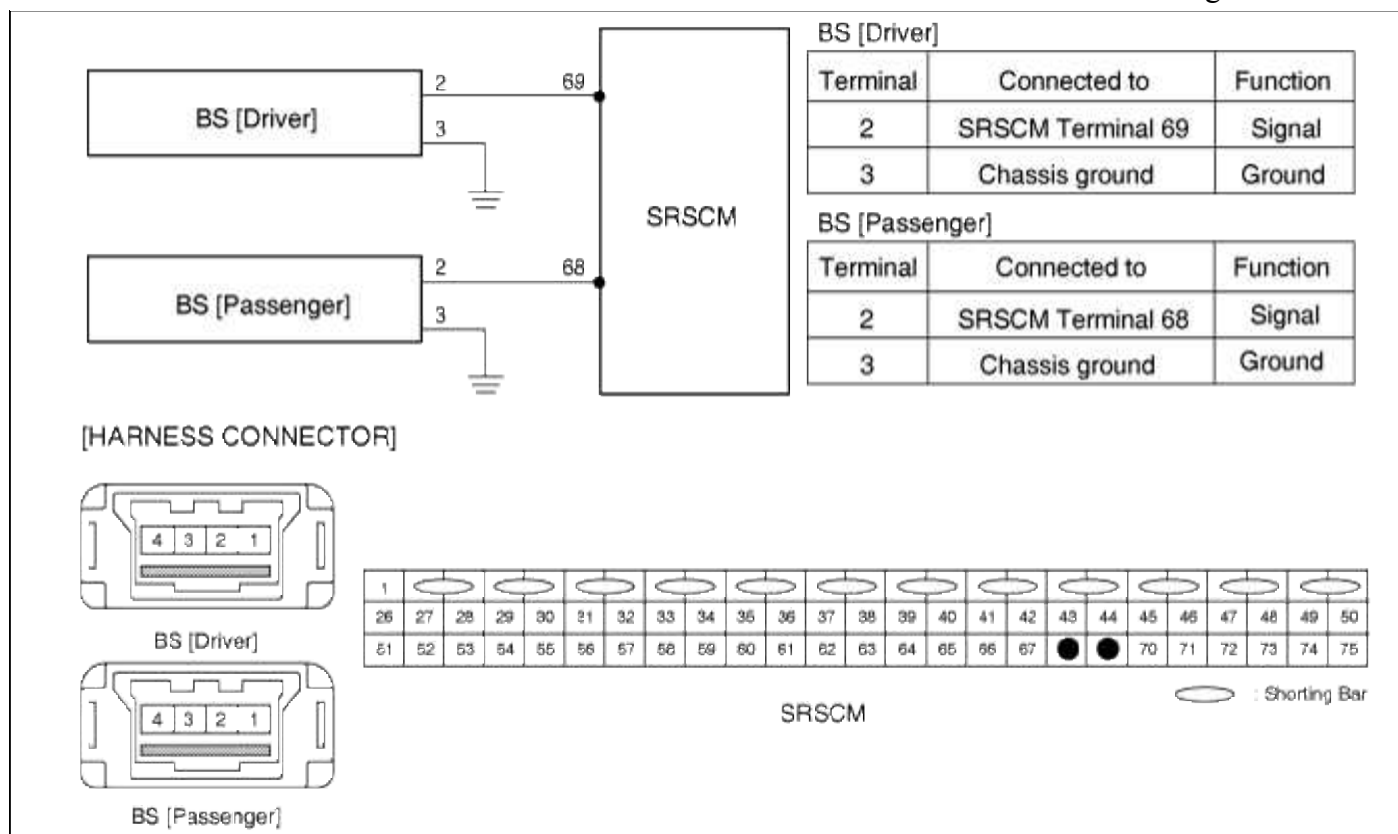
##### DTC Detecting Condition

DTC	Condition	Probable cause
B1511 B1513	<ul style="list-style-type: none"> <li>Open between BS and SRSCM (Current <math>I &lt; 4</math> mA).</li> <li>Short to battery line between BS and SRSCM (Current <math>I &lt; 4</math> mA)</li> <li>Seat Belt Buckle Switch (BS) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short to battery line circuit on wiring harness</li> <li>Seat Belt Buckle Switch (BS)</li> <li>SRSCM</li> </ul>

##### Specification

BS Status	Current (mA)	Related DTC
Open or Short to Battery	$I < 4$	B1511, B1513
Unbuckled	4 ~ 7	
Defect	7 ~ 12	B1515, B1516
Buckled	12 ~ 17	
Short or Short to Ground	$I > 17$	B1512, B1514

##### Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

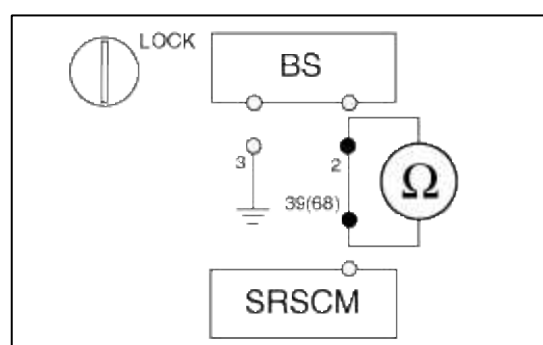
### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### 2. CHECK OPEN CIRCUIT

- (1) Disconnect the BS connector.
- (2) Measure resistance between the terminal 2 of BS harness connector and the terminal 69(68) of SRSCM harness connector.

specification (Resistance) : below 1  $\Omega$



(3) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the BS and the SRSCM.

### 3. CHECK SHORT TO BATTERY LINE

(1) Connect the battery negative cable to the battery.

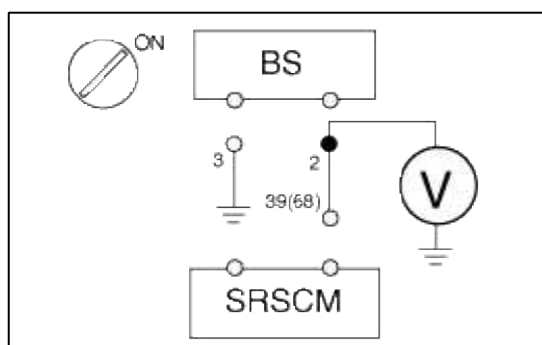
(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 2 of BS harness connector and chassis ground.

---

specification (voltage) : Approximately 0 V

---



(4) Is the measured voltage within specification?

**YES**

Check the Seat belt buckle switch(BS).

**NO**

Repair the short to battery line circuit on wiring harness between the BS and the SRSCM.

### 4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 2 of BS and 69(68) of SRSCM harness connector.

---

specification (current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

---

(2) Is the measured current within specification?

**YES**

Go to next step.

**NO**

Replace the BS.

### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Restraint > Troubleshooting > B1514 Buckle Switch Passenger short or short to Ground

### DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects short or short to ground on the BS circuit. This system decides whether the driver or passenger seat belt is buckled or not.

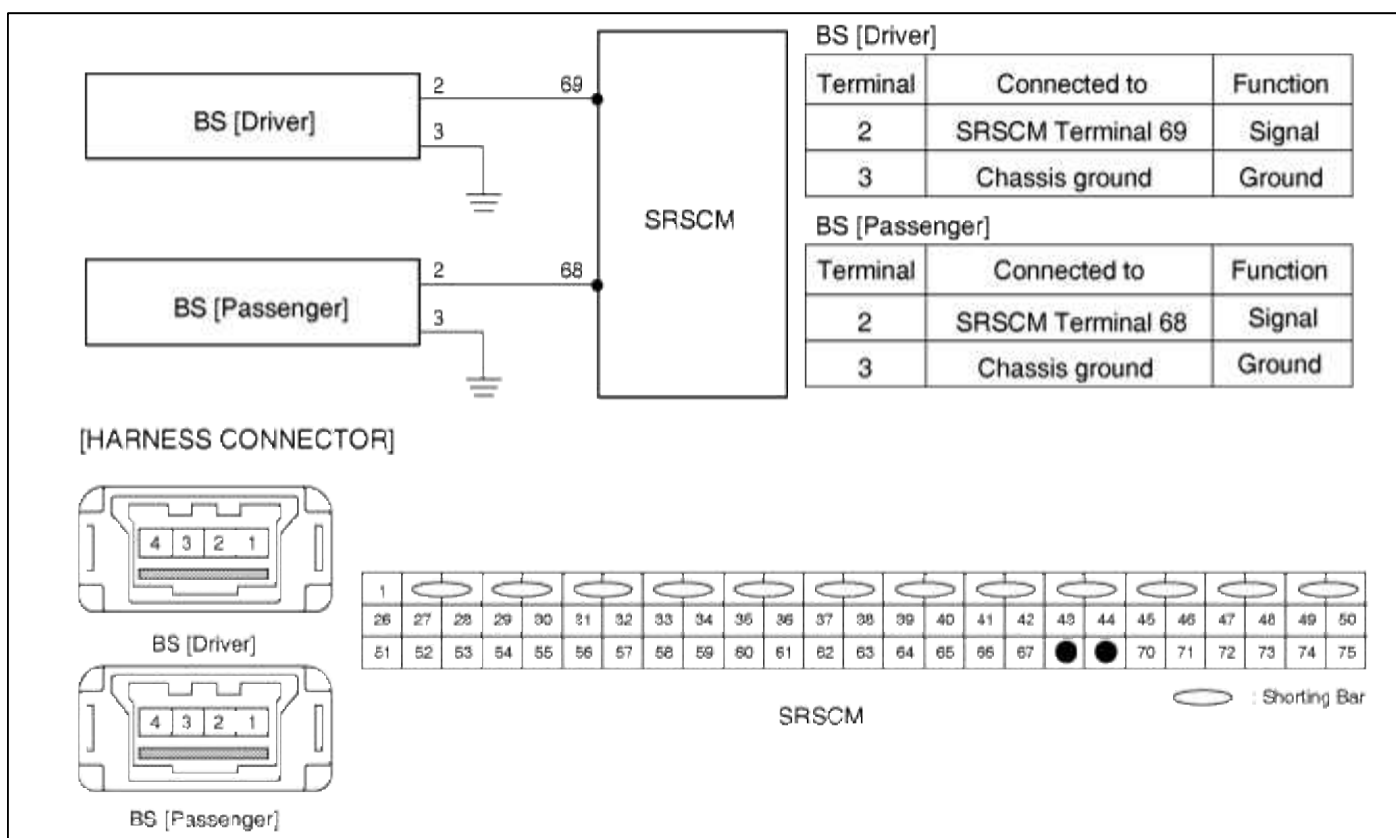
### DTC Detecting Condition

DTC	Condition	Probable cause
B1512 B1514	<ul style="list-style-type: none"> <li>Short or Short to ground between BS and SRSCM (Current <math>I &gt; 17</math> mA)</li> <li>Seat Belt Buckle Switch (BS) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>short or short to ground circuit on wiring harness</li> <li>Seat Belt Buckle Switch (BS)</li> <li>SRSCM</li> </ul>

### Specification

BS Status	Current (mA)	Related DTC
Open or Short to Battery	$I < 4$	B1511, B1513
Unbuckled	$4 \sim 7$	
Defect	$7 \sim 12$	B1515, B1516
Buckled	$12 \sim 17$	
Short or Short to Ground	$I > 17$	B1512, B1514

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

## 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

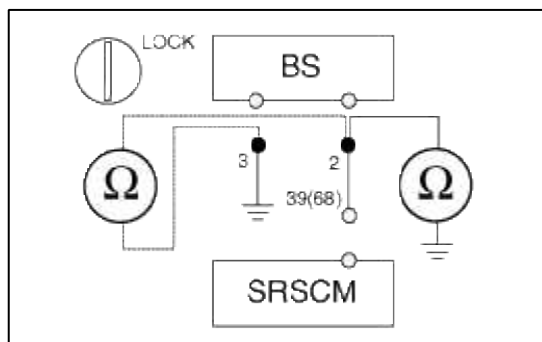
## 2. CHECK SHORT OR SHORT TO GROUND

- (1) Disconnect the BS connector.
- (2) Measure resistance between the terminal 2 of BS harness connector and chassis ground.
- (3) Measure resistance between the terminal 2 and 3 of BS harness connector.

---

specification (Resistance) : Infinite

---



- (4) Is the measured resistance within specification?

**YES**

- (5) Go to next step.

**NO**

Repair the short or short to ground circuit on wiring harness between the BS and the SRSCM.

## 3. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

- (1) Measure current between the terminal 2 of BS and 69(68) of SRSCM harness connector.

---

specification (current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

---

- (2) Is the measured current within specification?

**YES**

Go to next step.

**NO**

Replace the BS.

## 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1515 Buckle Switch Driver Defect

#### DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is buckled or not.

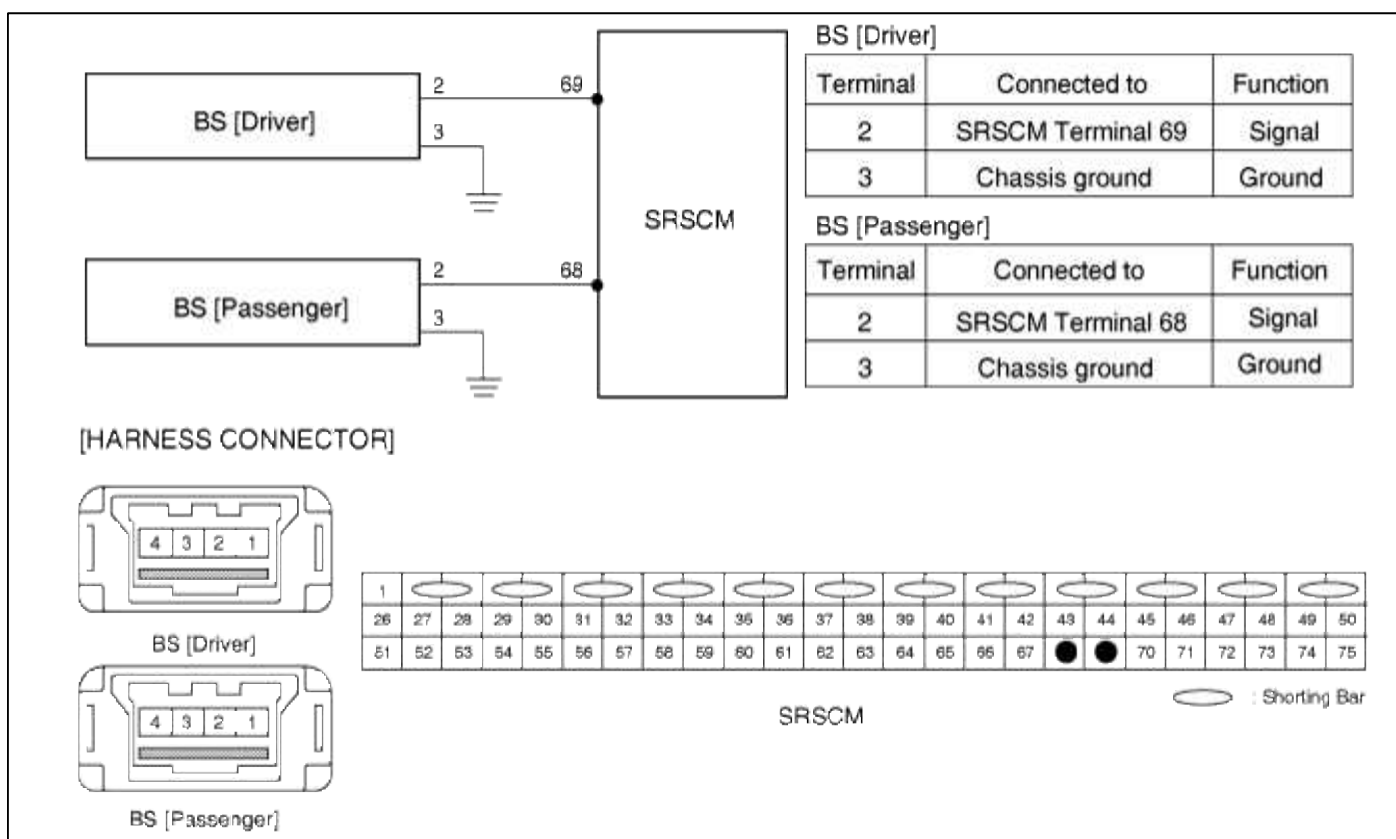
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	<ul style="list-style-type: none"> <li>• Seat Belt Buckle Switch (BS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Seat Belt Buckle Switch (BS)</li> <li>• SRSCM</li> </ul>

### Specification

BS Status	Current (mA)	Related DTC
Open or Short to Battery	$I < 4$	B1511, B1513
Unbuckled	4 ~ 7	
Defect	7 ~ 12	B1515, B1516
Buckled	12 ~ 17	
Short or Short to Ground	$I > 17$	B1512, B1514

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.



## 2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 2 of BS and 69(68) of SRSCM harness connector.

specification (current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

**YES**

Go to next step.

**NO**

Replace the BS.

## 3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

**Restraint > Troubleshooting > B1516 Buckle Switch Passenger Defect**

## DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is buckled or not.

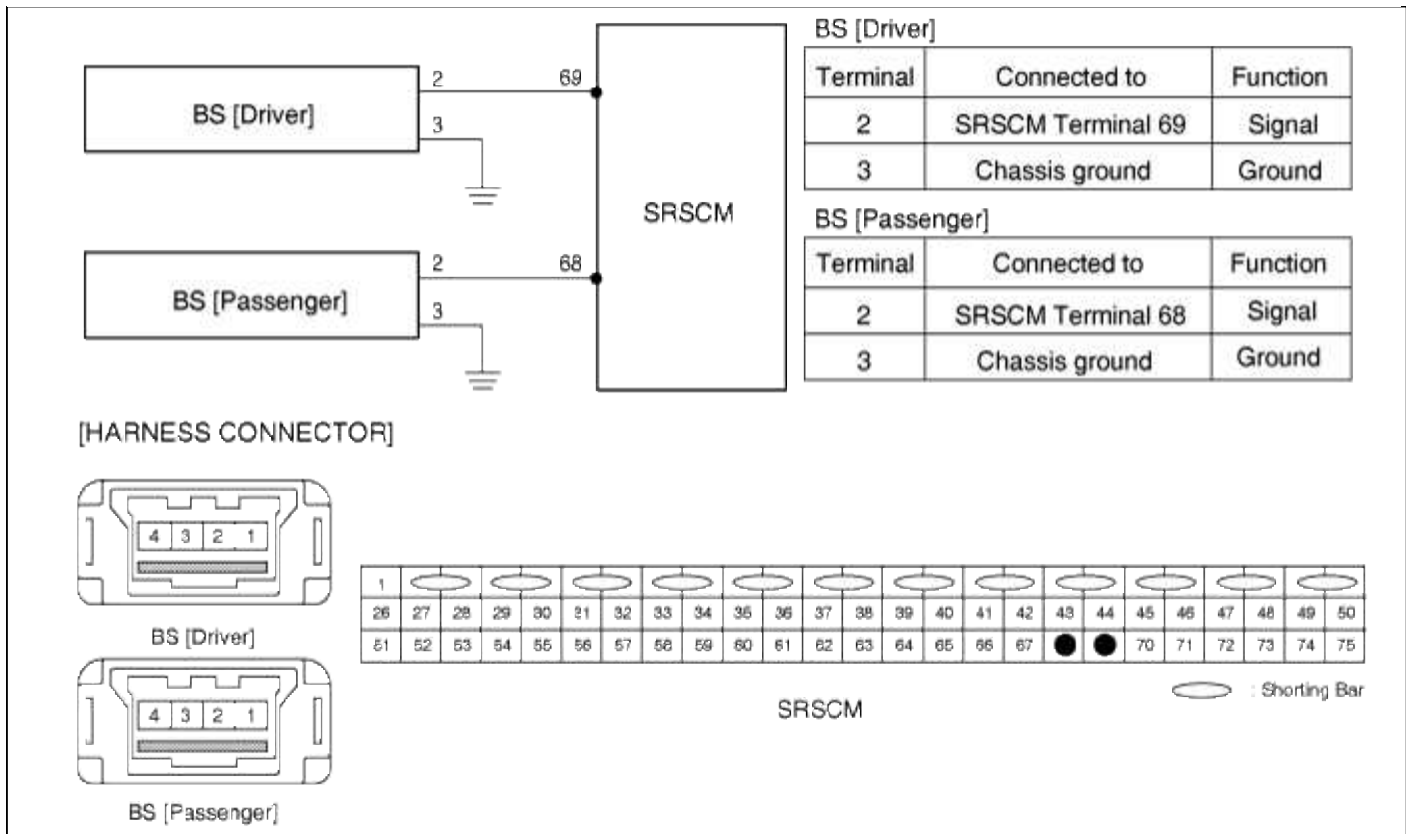
## DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	<ul style="list-style-type: none"> <li>• Seat Belt Buckle Switch (BS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Seat Belt Buckle Switch (BS)</li> <li>• SRSCM</li> </ul>

## Specification

BS Status	Current (mA)	Related DTC
Open or Short to Battery	$I < 4$	B1511, B1513
Unbuckled	4 ~ 7	
Defect	7 ~ 12	B1515, B1516
Buckled	12 ~ 17	
Short or Short to Ground	$I > 17$	B1512, B1514

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### 2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

- (1) Measure current between the terminal 2 of BS and 69(68) of SRSCM harness connector.

specification (current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

- (2) Is the measured current within specification?

**YES**

Go to next step.

**NO**

Replace the BS.

### 3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Restraint > Troubleshooting > B1517 Buckle Switch Driver Instability

### DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is buckled or not.

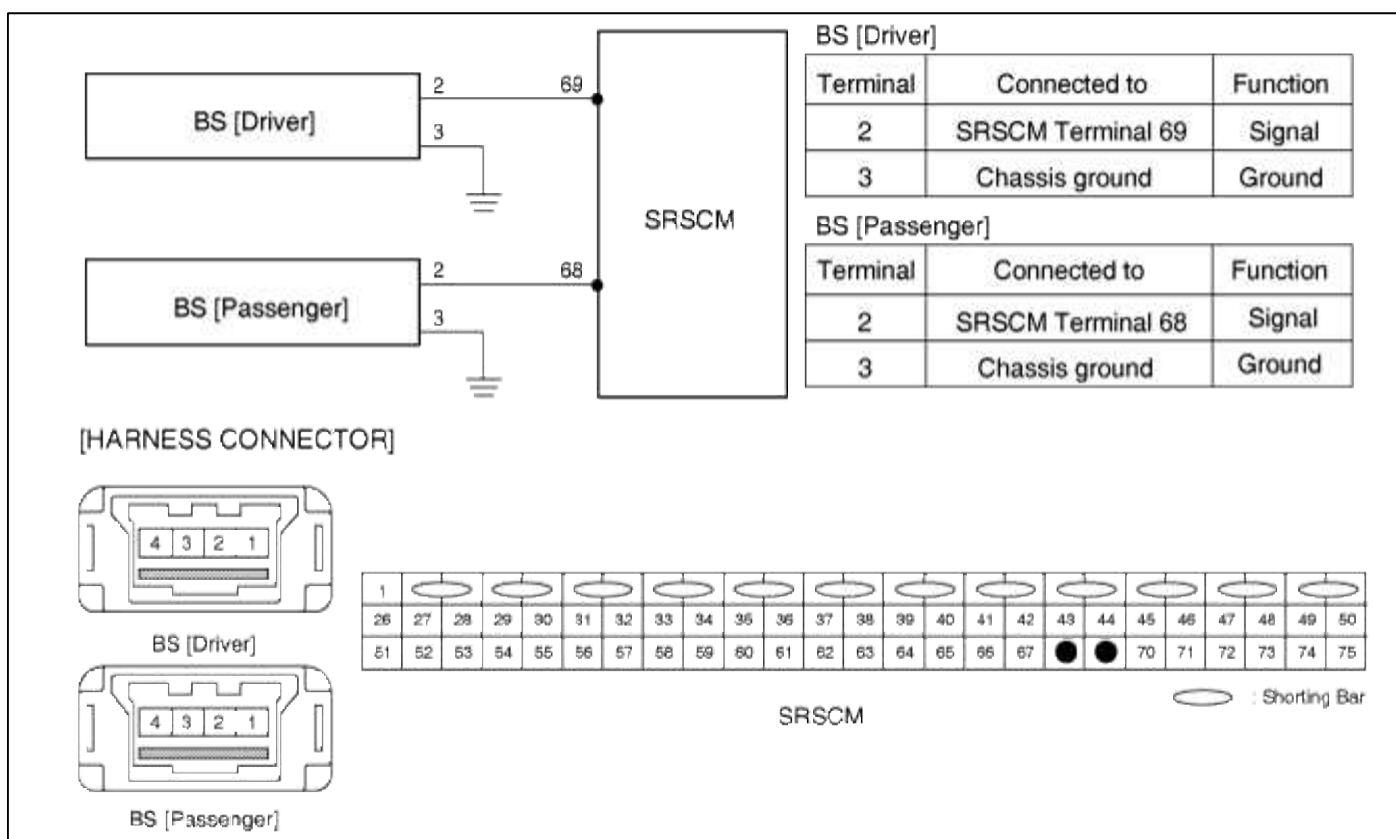
### DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	<ul style="list-style-type: none"> <li>• Seat Belt Buckle Switch (BS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Seat Belt Buckle Switch (BS)</li> <li>• SRSCM</li> </ul>

### Specification

BS Status	Current (mA)	Related DTC
Open or Short to Battery	$I < 4$	B1511, B1513
Unbuckled	4 ~ 7	
Defect	7 ~ 12	B1515, B1516
Buckled	12 ~ 17	
Short or Short to Ground	$I > 17$	B1512, B1514

### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 2 of BS and 69(68) of SRSCM harness connector.

specification (current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

**YES**

Go to next step.

**NO**

Replace the BS.

## 3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1518 Buckle Switch Passenger instability

#### DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects the BS faults. This system decides whether the driver or passenger seat belt is buckled or not.

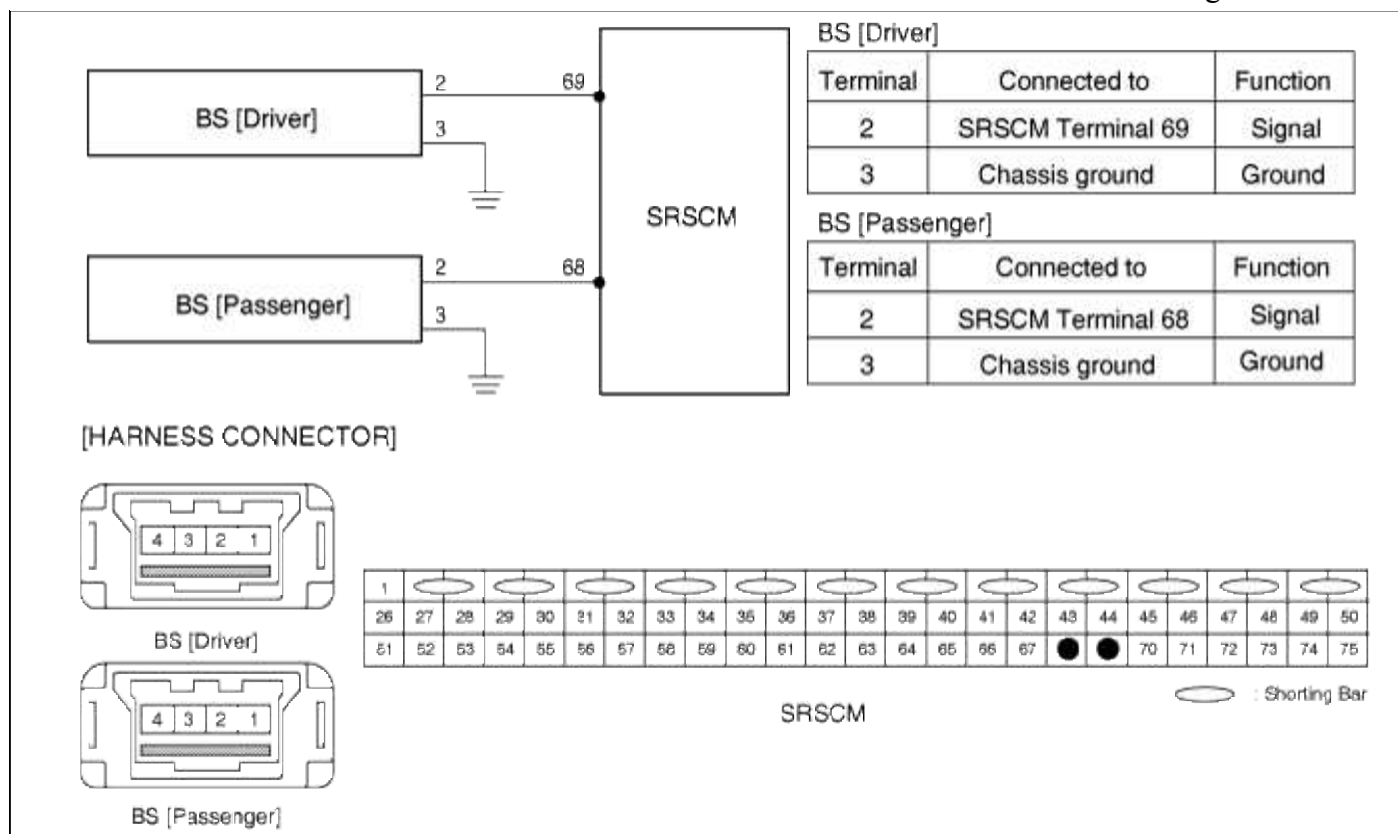
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1515 B1516 B1517 B1518	<ul style="list-style-type: none"> <li>• Seat Belt Buckle Switch (BS) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Seat Belt Buckle Switch (BS)</li> <li>• SRSCM</li> </ul>

#### Specification

BS Status	Current (mA)	Related DTC
Open or Short to Battery	$I < 4$	B1511, B1513
Unbuckled	4 ~ 7	
Defect	7 ~ 12	B1515, B1516
Buckled	12 ~ 17	
Short or Short to Ground	$I > 17$	B1512, B1514

#### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 2 of BS and 69(68) of SRSCM harness connector.

specification (current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

**YES**

Go to next step.

**NO**

Replace the BS.

#### 3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1620 Internal fault-Replace SRSCM

#### DTC DESCRIPTION

The Supplemental Restraint System Control Module (SRSCM) runs diagnostics to monitor the condition of its internal circuits and all external components in the restraint system. If a fault is detected in the electronic accelerometer or in the microprocessor, the SRSCM will inhibit deployment to minimize the risk of inadvertent deployments.

Once an internal fault is qualified, the internal fault is latched and warning lamp will be turned on. If an internal fault is

qualified, the SRSCM must be replaced. The Hi-Scan tool can't clear an internal fault. All internal faults are DTC B1620.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1620	<ul style="list-style-type: none"> <li>SRSCM internal fault : acceleration sensor, microcomputer power supply, watchdog etc</li> </ul>	<ul style="list-style-type: none"> <li>SRSCM</li> </ul>

#### INSPECTION PROCEDURE

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool, the SRSCM should be replaced.

#### Restraint > Troubleshooting > B1650 Crash Recorded in 1st Stage Only(Frontal-Replace SRSCM)

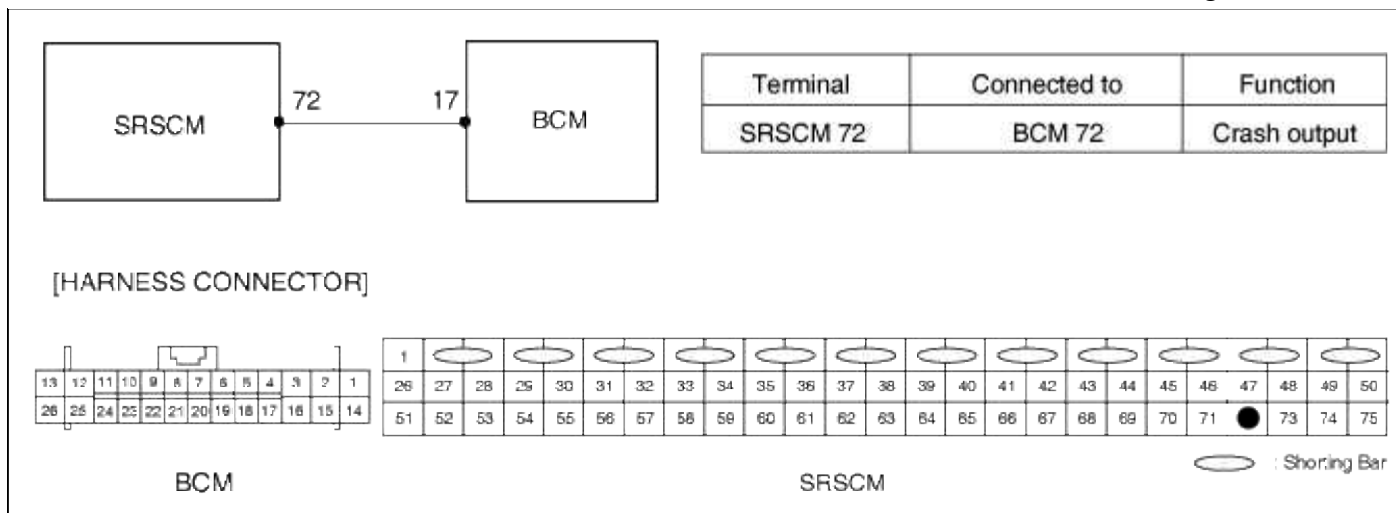
#### DTC Description

When a deployment of any restraint system for seat belt pretensioner and frontal and side air bags occurs, the crash output is activated. The purpose of this output is to signal body control module (BCM) in the vehicle to unlock the vehicle doors. If a crash output is in progress, a second crash output signal will not be sent unless the first one is completed. The SRSCM doesn't perform diagnostics on the crash output function. After a frontal or side crash event is sensed and algorithm makes firing decision, above mentioned crash record is stored after squib deployment.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1651 B1652 B1655 B1657 B1658 B1670	<ul style="list-style-type: none"> <li>Frontal crash</li> <li>Side crash</li> <li>Seat belt pretensioner deployed</li> </ul>	<ul style="list-style-type: none"> <li>SRSCM</li> <li>Front Impact Sensor</li> <li>Side Impact Sensor</li> <li>Seat Belt Pretensioner</li> </ul>

#### Schematic Diagram



### Inspection Procedure

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool except for the B1657, and the SRSCM should be replaced. However, for the DTC B1657, Belt pretensioner only deployment, it can be erased for 5 times and the SRSCM can be reusable. If the deployment of Belt pretensioner reaches to 6 times, the SRSCM will set DTC B1658 and the SRSCM should be replaced accordingly.

### Restraint > Troubleshooting > B1651 Crash Recorded in Front-Driver Side Airbag(Replace SRSCM)

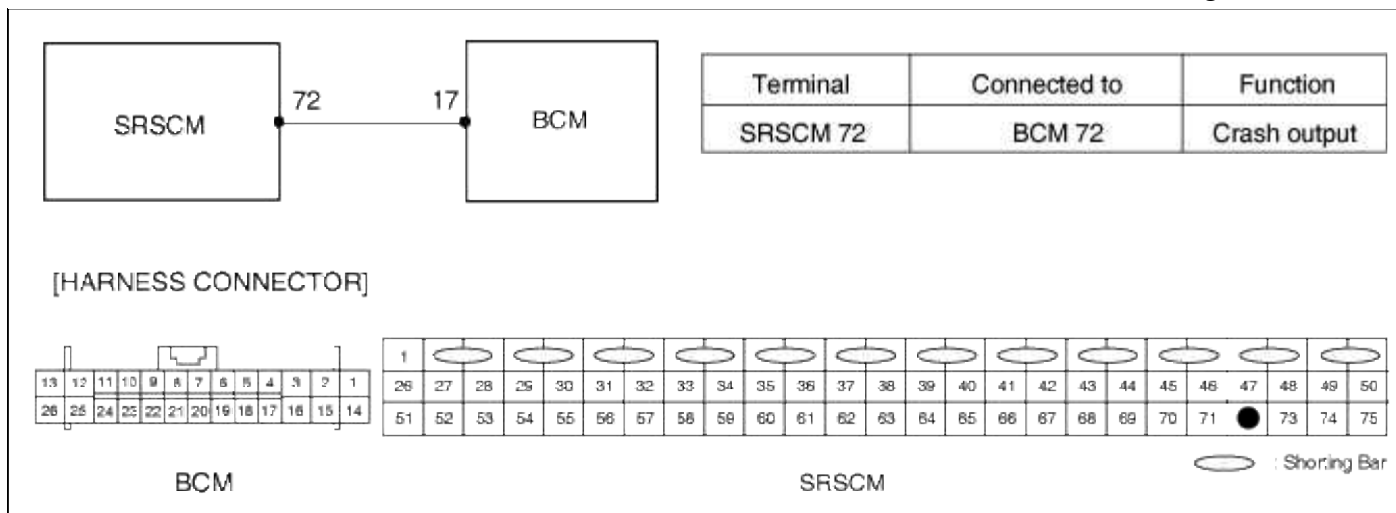
#### DTC Description

When a deployment of any restraint system for seat belt pretensioner and frontal and side air bags occurs, the crash output is activated. The purpose of this output is to signal body control module (BCM) in the vehicle to unlock the vehicle doors. If a crash output is in progress, a second crash output signal will not be sent unless the first one is completed. The SRSCM doesn't perform diagnostics on the crash output function. After a frontal or side crash event is sensed and algorithm makes firing decision, above mentioned crash record is stored after squib deployment.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1651 B1652 B1655 B1657 B1658 B1670	<ul style="list-style-type: none"> <li>• Frontal crash</li> <li>• Side crash</li> <li>• Seat belt pretensioner deployed</li> </ul>	<ul style="list-style-type: none"> <li>• SRSCM</li> <li>• Front Impact Sensor</li> <li>• Side Impact Sensor</li> <li>• Seat Belt Pretensioner</li> </ul>

#### Schematic Diagram



### Inspection Procedure

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool except for the B1657, and the SRSCM should be replaced. However, for the DTC B1657, Belt pretensioner only deployment, it can be erased for 5 times and the SRSCM can be reusable. If the deployment of Belt pretensioner reaches to 6 times, the SRSCM will set DTC B1658 and the SRSCM should be replaced accordingly.

### Restraint > Troubleshooting > B1652 Crash Recorded in Front-Passenger Side Airbag(Replace SRSCM)

#### DTC Description

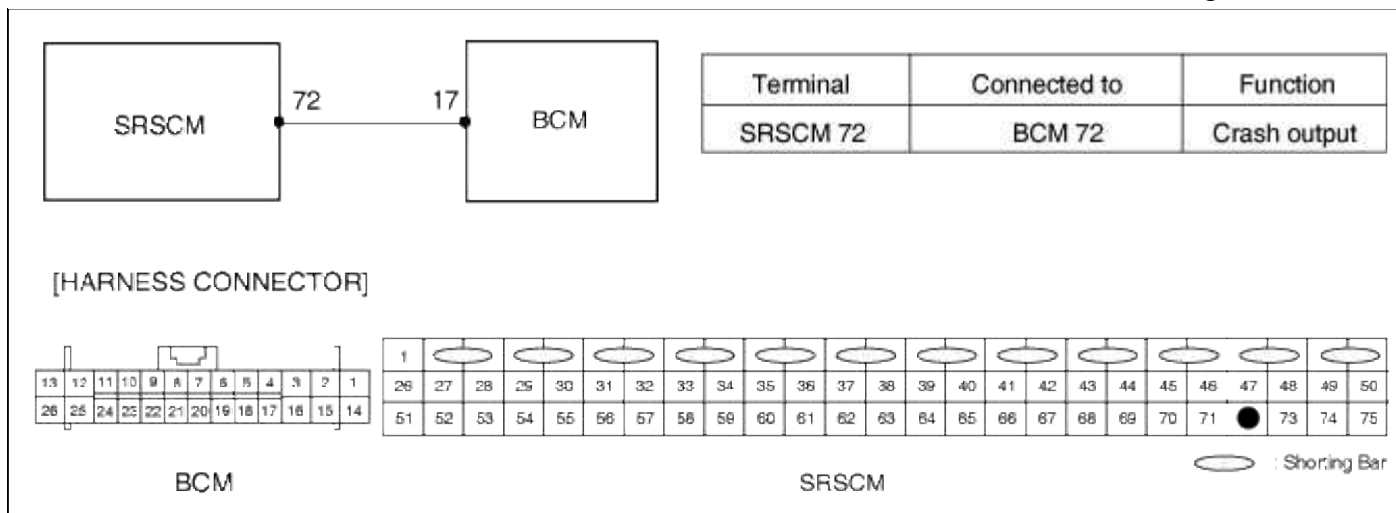
When a deployment of any restraint system for seat belt pretensioner and frontal and side air bags occurs, the crash output is activated. The purpose of this output is to signal body control module (BCM) in the vehicle to unlock the vehicle doors. If a crash output is in progress, a second crash output signal will not be sent unless the first one is completed. The SRSCM doesn't perform diagnostics on the crash output function. After a frontal or side crash event is sensed and algorithm makes firing decision, above mentioned crash record is stored after squib deployment.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1651 B1652 B1655 B1657 B1658 B1670	<ul style="list-style-type: none"> <li>• Frontal crash</li> <li>• Side crash</li> <li>• Seat belt pretensioner deployed</li> </ul>	<ul style="list-style-type: none"> <li>• SRSCM</li> <li>• Front Impact Sensor</li> <li>• Side Impact Sensor</li> <li>• Seat Belt Pretensioner</li> </ul>

#### Schematic Diagram





### Inspection Procedure

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool except for the B1657, and the SRSCM should be replaced. However, for the DTC B1657, Belt pretensioner only deployment, it can be erased for 5 times and the SRSCM can be reusable. If the deployment of Belt pretensioner reaches to 6 times, the SRSCM will set DTC B1658 and the SRSCM should be replaced accordingly.

### Restraint > Troubleshooting > B1655 Crash recorded (Side - Replace SRSCM)

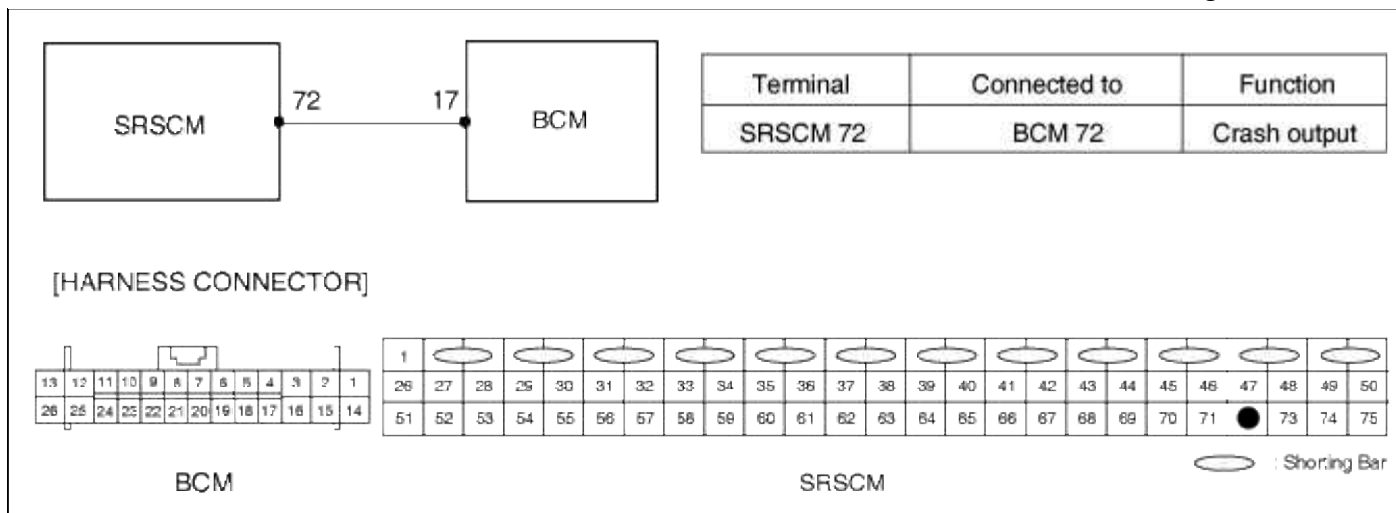
#### DTC Description

When a deployment of any restraint system for seat belt pretensioner and frontal and side air bags occurs, the crash output is activated. The purpose of this output is to signal body control module (BCM) in the vehicle to unlock the vehicle doors. If a crash output is in progress, a second crash output signal will not be sent unless the first one is completed. The SRSCM doesn't perform diagnostics on the crash output function. After a frontal or side crash event is sensed and algorithm makes firing decision, above mentioned crash record is stored after squib deployment.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1651 B1652 B1655 B1657 B1658 B1670	<ul style="list-style-type: none"> <li>• Frontal crash</li> <li>• Side crash</li> <li>• Seat belt pretensioner deployed</li> </ul>	<ul style="list-style-type: none"> <li>• SRSCM</li> <li>• Front Impact Sensor</li> <li>• Side Impact Sensor</li> <li>• Seat Belt Pretensioner</li> </ul>

### Schematic Diagram



### Inspection Procedure

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool except for the B1657, and the SRSCM should be replaced. However, for the DTC B1657, Belt pretensioner only deployment, it can be erased for 5 times and the SRSCM can be reusable. If the deployment of Belt pretensioner reaches to 6 times, the SRSCM will set DTC B1658 and the SRSCM should be replaced accordingly.

### Restraint > Troubleshooting > B1657 Crash Recorded in Belt Pretensioner only

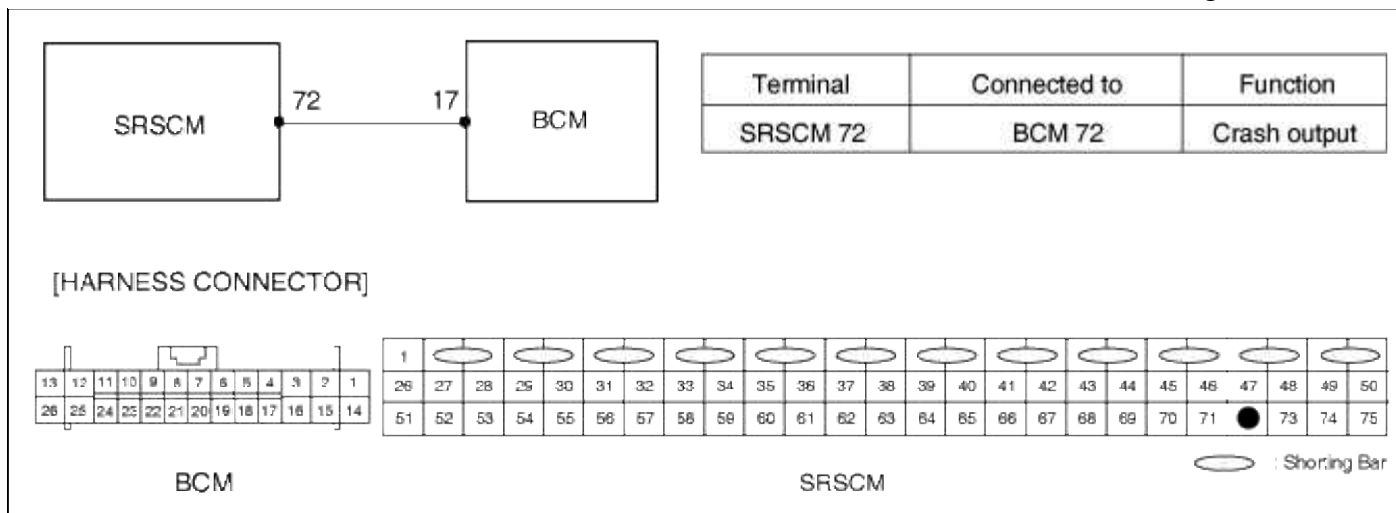
#### DTC Description

When a deployment of any restraint system for seat belt pretensioner and frontal and side air bags occurs, the crash output is activated. The purpose of this output is to signal body control module (BCM) in the vehicle to unlock the vehicle doors. If a crash output is in progress, a second crash output signal will not be sent unless the first one is completed. The SRSCM doesn't perform diagnostics on the crash output function. After a frontal or side crash event is sensed and algorithm makes firing decision, above mentioned crash record is stored after squib deployment.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1651 B1652 B1655 B1657 B1658 B1670	<ul style="list-style-type: none"> <li>• Frontal crash</li> <li>• Side crash</li> <li>• Seat belt pretensioner deployed</li> </ul>	<ul style="list-style-type: none"> <li>• SRSCM</li> <li>• Front Impact Sensor</li> <li>• Side Impact Sensor</li> <li>• Seat Belt Pretensioner</li> </ul>

### Schematic Diagram



### Inspection Procedure

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool except for the B1657, and the SRSCM should be replaced. However, for the DTC B1657, Belt pretensioner only deployment, it can be erased for 5 times and the SRSCM can be reusable. If the deployment of Belt pretensioner reaches to 6 times, the SRSCM will set DTC B1658 and the SRSCM should be replaced accordingly.

### Restraint > Troubleshooting > B1658 Belt Pretensioner 6 times Deployment

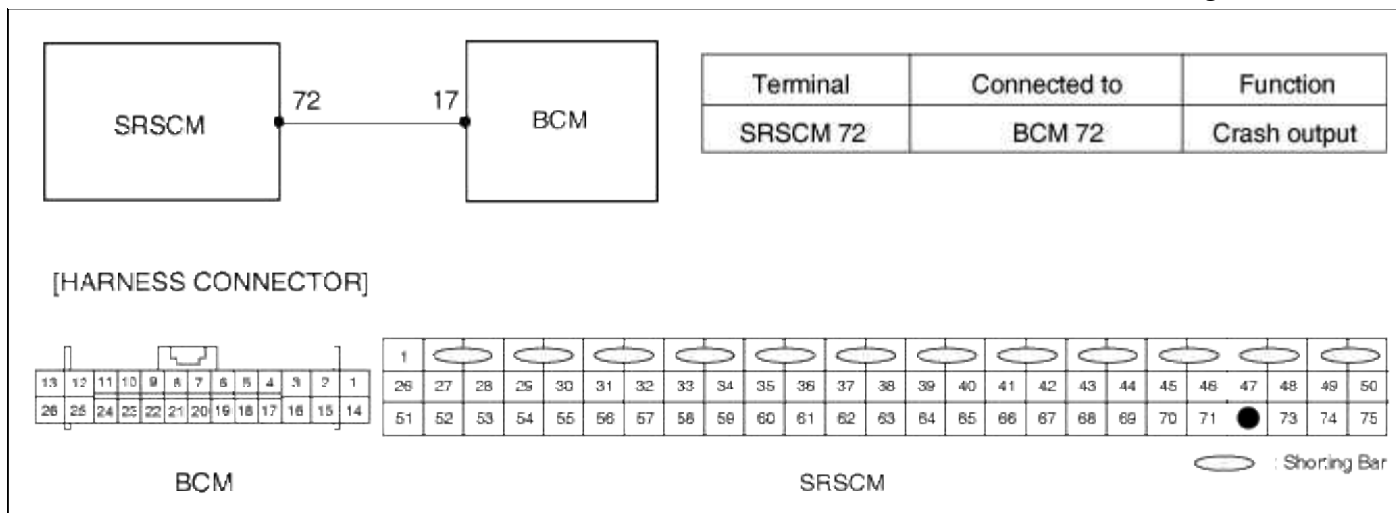
#### DTC Description

When a deployment of any restraint system for seat belt pretensioner and frontal and side air bags occurs, the crash output is activated. The purpose of this output is to signal body control module (BCM) in the vehicle to unlock the vehicle doors. If a crash output is in progress, a second crash output signal will not be sent unless the first one is completed. The SRSCM doesn't perform diagnostics on the crash output function. After a frontal or side crash event is sensed and algorithm makes firing decision, above mentioned crash record is stored after squib deployment.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1651 B1652 B1655 B1657 B1658 B1670	<ul style="list-style-type: none"> <li>• Frontal crash</li> <li>• Side crash</li> <li>• Seat belt pretensioner deployed</li> </ul>	<ul style="list-style-type: none"> <li>• SRSCM</li> <li>• Front Impact Sensor</li> <li>• Side Impact Sensor</li> <li>• Seat Belt Pretensioner</li> </ul>

### Schematic Diagram



### Inspection Procedure

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool except for the B1657, and the SRSCM should be replaced. However, for the DTC B1657, Belt pretensioner only deployment, it can be erased for 5 times and the SRSCM can be reusable. If the deployment of Belt pretensioner reaches to 6 times, the SRSCM will set DTC B1658 and the SRSCM should be replaced accordingly.

### Restraint > Troubleshooting > B1670 Crash recorded in full stage(Frontal-Replace SRSCM)

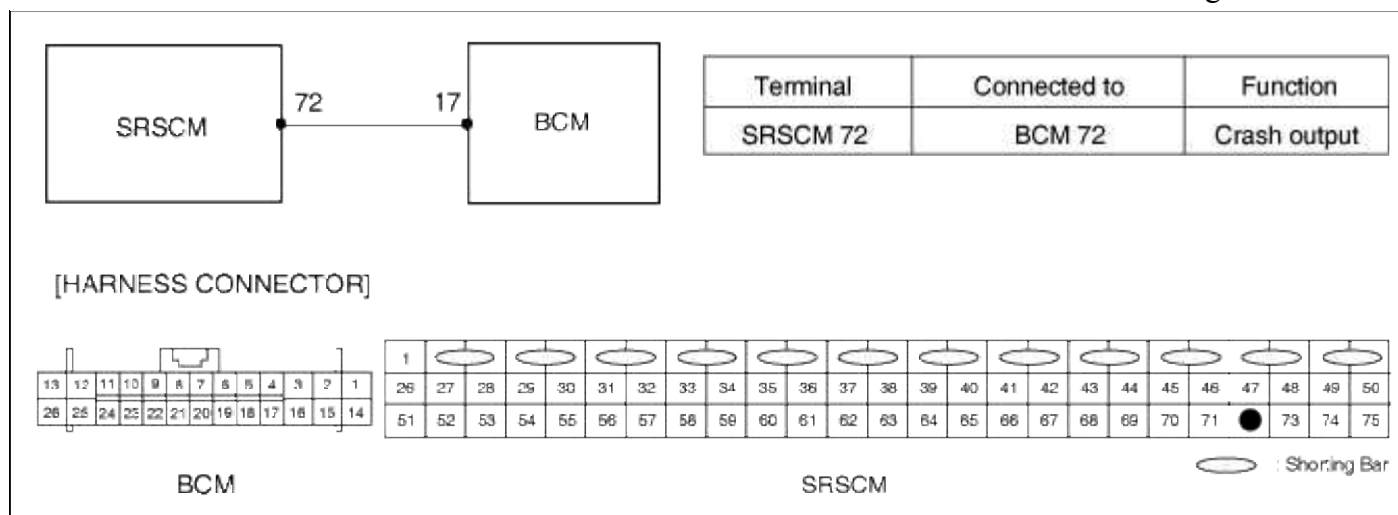
#### DTC Description

When a deployment of any restraint system for seat belt pretensioner and frontal and side air bags occurs, the crash output is activated. The purpose of this output is to signal body control module (BCM) in the vehicle to unlock the vehicle doors. If a crash output is in progress, a second crash output signal will not be sent unless the first one is completed. The SRSCM doesn't perform diagnostics on the crash output function. After a frontal or side crash event is sensed and algorithm makes firing decision, above mentioned crash record is stored after squib deployment.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1650 B1651 B1652 B1655 B1657 B1658 B1670	<ul style="list-style-type: none"> <li>• Frontal crash</li> <li>• Side crash</li> <li>• Seat belt pretensioner deployed</li> </ul>	<ul style="list-style-type: none"> <li>• SRSCM</li> <li>• Front Impact Sensor</li> <li>• Side Impact Sensor</li> <li>• Seat Belt Pretensioner</li> </ul>

### Schematic Diagram



### Inspection Procedure

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool except for the B1657, and the SRSCM should be replaced. However, for the DTC B1657, Belt pretensioner only deployment, it can be erased for 5 times and the SRSCM can be reusable. If the deployment of Belt pretensioner reaches to 6 times, the SRSCM will set DTC B1658 and the SRSCM should be replaced accordingly.

### Restraint > Troubleshooting > B1711 Knee airbag – Driver resistance too High

#### DTC Description

The Knee Airbag circuit consists of the SRSCM and Knee Airbag (KAB). The SRSCM sets above DTC(s) if it detects that the resistance of KAB squib is too high or low.

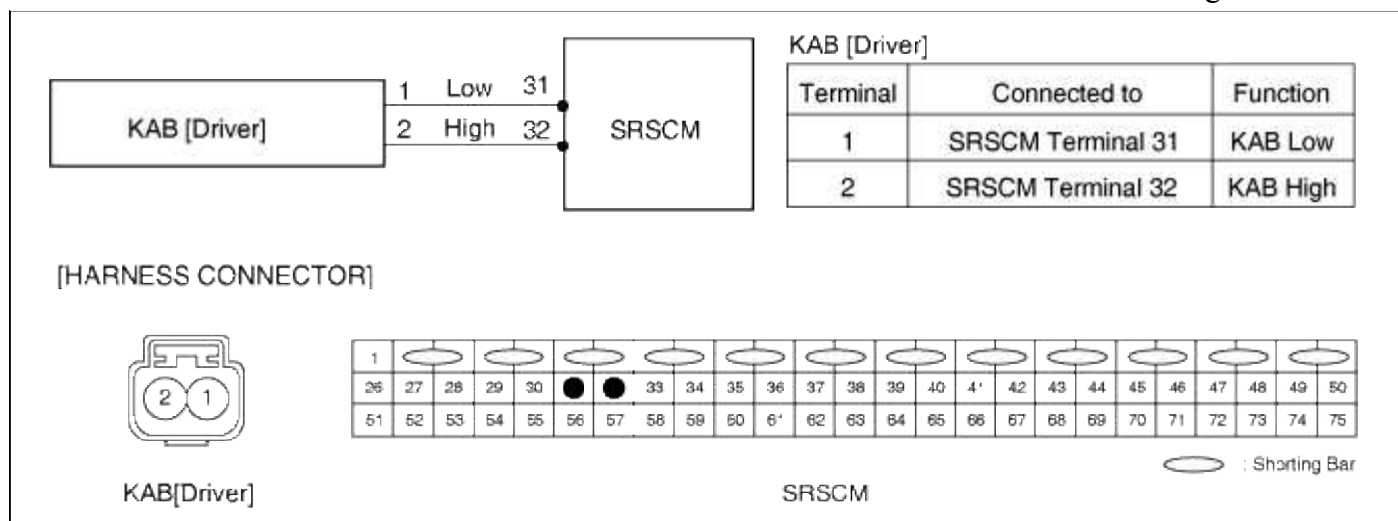
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1711 B1712	<ul style="list-style-type: none"> <li>Too high or low resistance between KAB high(+) and KAB low (-)</li> <li>Knee Airbag (KAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Knee Airbag (KAB) squib</li> <li>SRSCM</li> </ul>

#### Specification

KAB resistance : 1.4 ~ 4.5  $\Omega$

#### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

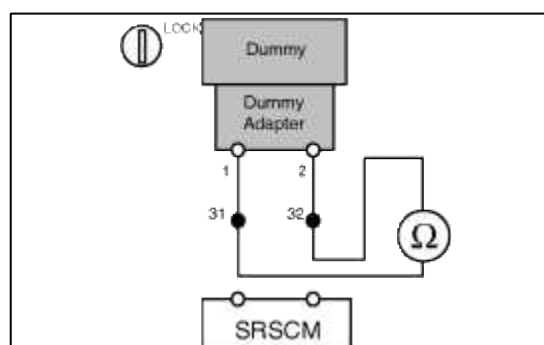
#### 2. CHECK KAB RESISTANCE

#### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on KAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 31 and 32 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Knee Airbag(KAB) module.

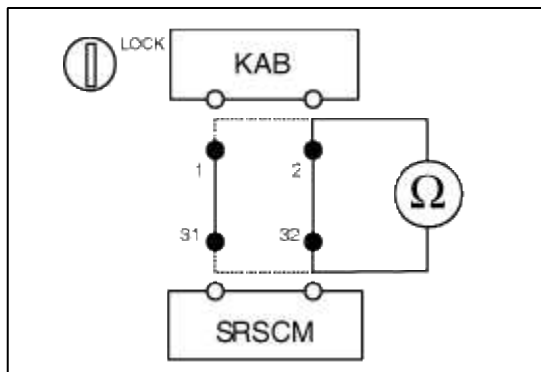
**NO**

Check open circuit.

### 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of KAB harness connector and the terminal 32 of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of SAB harness connector and the terminal 31 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Check short circuit.

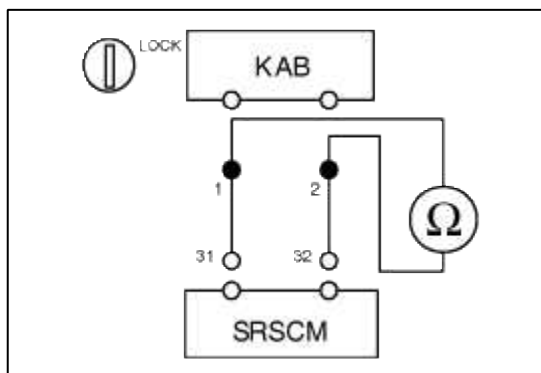
**NO**

Repair or replace the wiring harness between the KAB and the SRSCM.

### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of KAB harness connector.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the KAB and the SRSCM.

### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

**Restraint > Troubleshooting > B1712 Knee airbag – Driver resistance too Low**

DTC Description

The Knee Airbag circuit consists of the SRSCM and Knee Airbag (KAB). The SRSCM sets above DTC(s) if it detects that the resistance of KAB squib is too high or low.

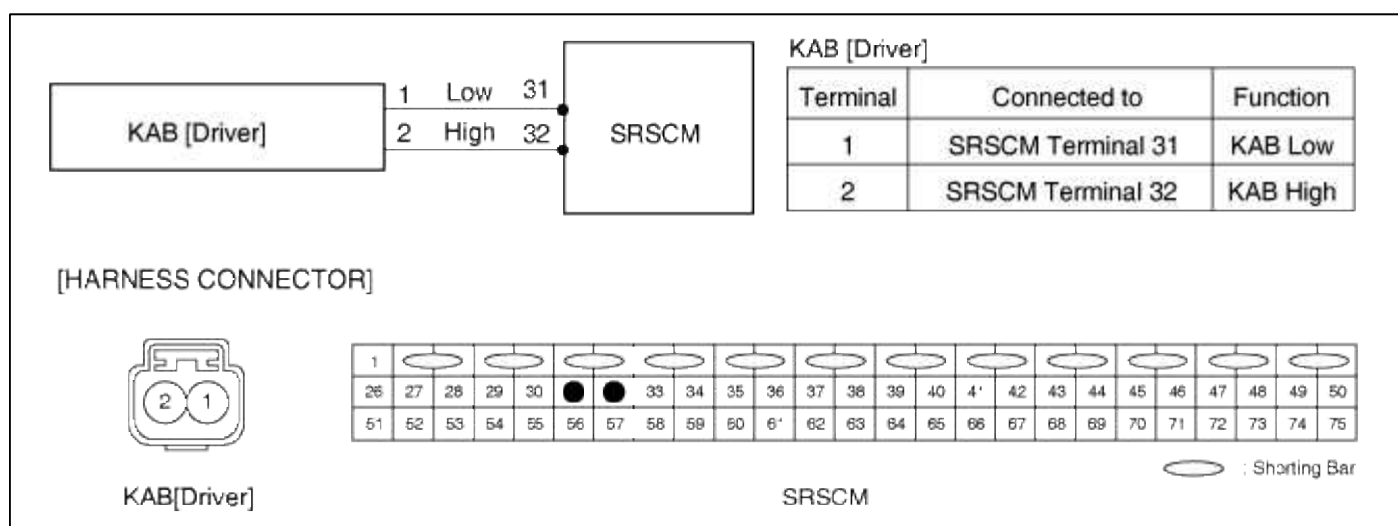
#### DTC Detecting Condition

DTC	Condition	Probable cause
B1711 B1712	<ul style="list-style-type: none"> <li>Too high or low resistance between KAB high(+) and KAB low (-)</li> <li>Knee Airbag (KAB) Malfunction</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit on wiring harness</li> <li>Knee Airbag (KAB) squib</li> <li>SRSCM</li> </ul>

#### Specification

KAB resistance : 1.4 ~ 4.5  $\Omega$

#### Schematic Diagram



#### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Inspection Procedure

##### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.



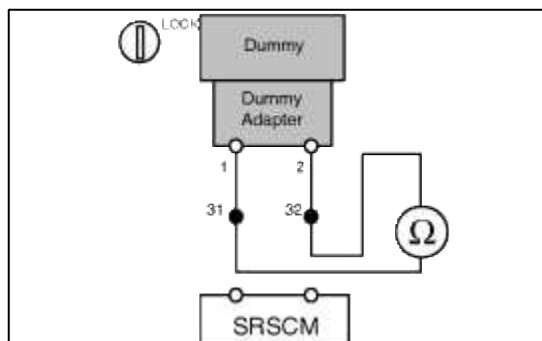
## 2. CHECK KAB RESISTANCE

### CAUTION

Never attempt to measure the circuit resistance of the airbag module(squib) with an ohmmeter.

- (1) Connect the Dummy and the Dummy Adapter on KAB harness connector.
  - Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.
- (2) Measure resistance between the terminal 31 and 32 of SRSCM harness connector.

Specification (resistance) : 1.4 ~ 4.5  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Replace the Knee Airbag(KAB) module.

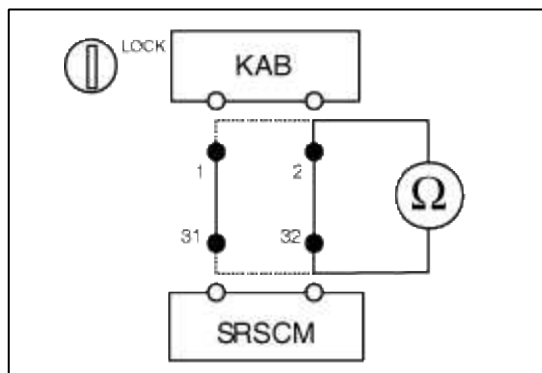
**NO**

Check open circuit.

## 3. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 2 of KAB harness connector and the terminal 32 of SRSCM harness connector.
- (2) Measure resistance between the terminal 1 of SAB harness connector and the terminal 31 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (3) Is the measured resistance within specification?

**YES**

Check short circuit.

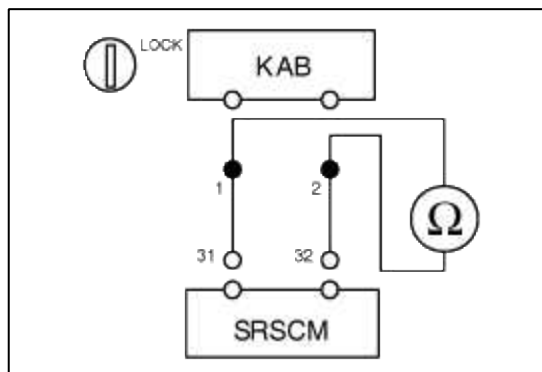
**NO**

Repair or replace the wiring harness between the KAB and the SRSCM.

#### 4. CHECK SHORT CIRCUIT

- (1) Measure resistance between the terminal 1 and 2 of KAB harness connector.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair or replace the wiring harness between the KAB and the SRSCM.

#### 5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B1713 Knee airbag – Driver resistance circuit short to Ground

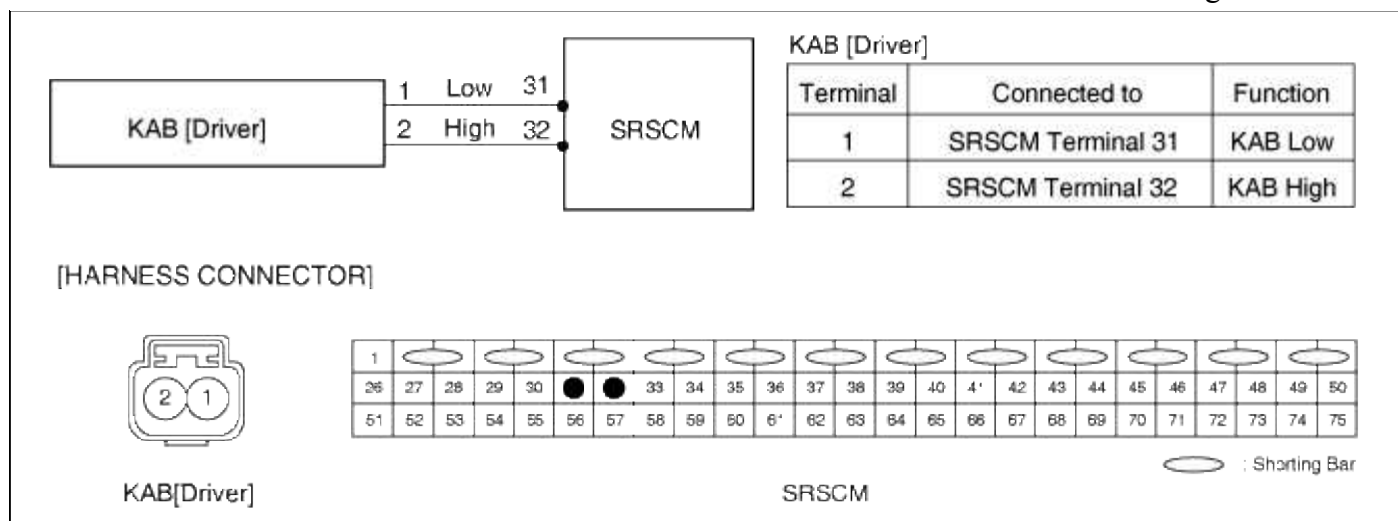
#### DTC Description

The Knee Airbag circuit consists of the SRSCM and Knee Airbag (KAB). The SRSCM sets above DTC(s) if it detects short to ground on the KAB circuit.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B1713	<ul style="list-style-type: none"> <li>• Short to ground between KAB and SRSCM</li> <li>• Knee Airbag (KAB) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to ground circuit on wiring harness</li> <li>• Knee Airbag (KAB) squib</li> <li>• SRSCM</li> </ul>

#### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

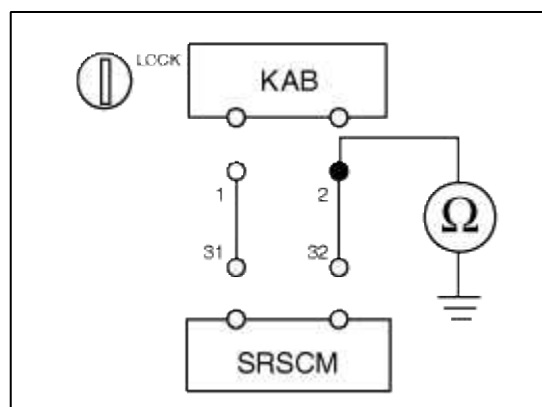
#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK SHORT TO GROUND

- (1) Measure resistance between the terminal 1 of KAB harness connector and chassis ground.

Specification (resistance) : infinite



- (2) Is the measured resistance within specification?

**YES**

Check the KAB Module.

**NO**

Repair or replace the wiring harness between the KAB and the SRSCM.

### 3. CHECK THE SAB MODULE

- (1) Replace the Knee Airbag(KAB) with a new one.
  - Refer to "Knee Airbag(KAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Knee Airbag(KAB)?

**YES**

Go to next step.

**NO**

Replace KAB module.

### 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section

#### Restraint > Troubleshooting > B1714 Knee airbag – Driver resistance circuit short to Battery

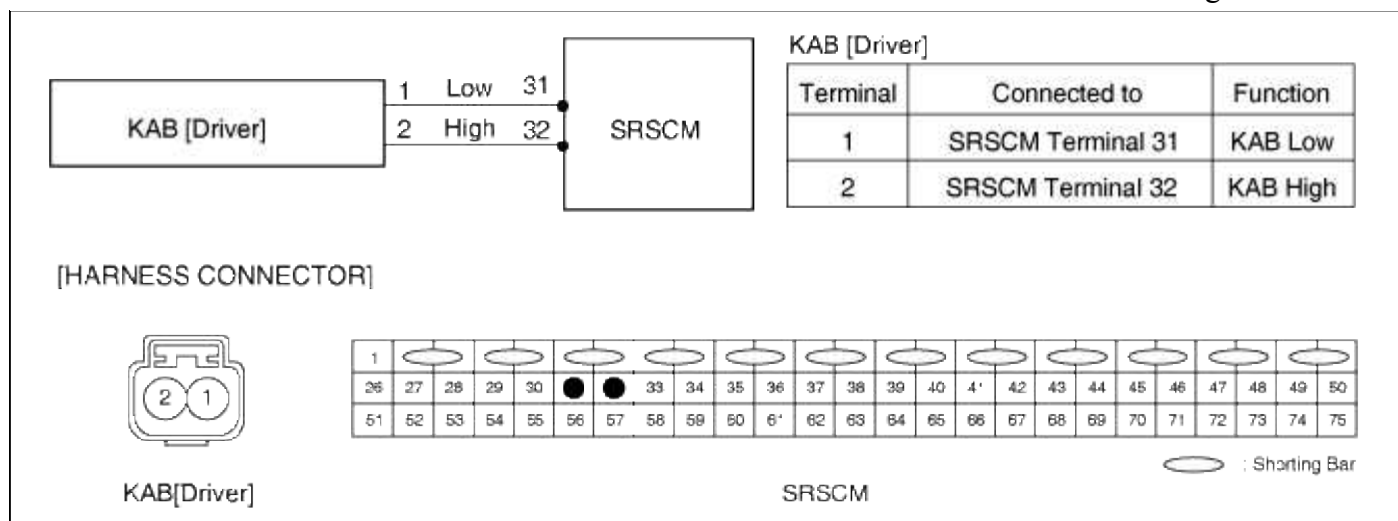
##### DTC Description

The Knee Airbag circuit consists of the SRSCM and Knee Airbag (KAB). The SRSCM sets above DTC(s) if it detects short to battery line on the KAB circuit.

##### DTC Detecting Condition

DTC	Condition	Probable cause
B1714	<ul style="list-style-type: none"> <li>• Short to battery line between KAB and SRSCM</li> <li>• Knee Airbag (KAB) Malfunction</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Short to battery line circuit on wiring harness</li> <li>• Knee Airbag (KAB) squib</li> <li>• SRSCM</li> </ul>

##### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

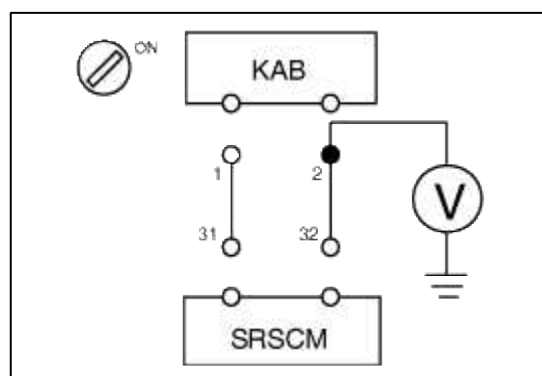
#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK SHORT TO BATTERY LINE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 1 of KAB harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



- (4) Is the measured voltage within specification?

**YES**

Check the KAB Module.

**NO**

Repair the short to battery line circuit on wiring harness between the KAB and the SRSCM.

### 3. CHECK THE KAB MODULE

- (1) Replace the Knee Airbag(KAB) with a new one.
  - Refer to "Knee Airbag(KAB)" section in this SERVICE MANUAL.
- (2) Install the DAB module and connect the DAB connector.
- (3) Connect the connectors of the PAB, KAB, CAB, BPT, FIS and SIS.
- (4) Connect the SRSCM connector.
- (5) Connect the battery negative cable to the battery.
- (6) Connect a Hi-Scan(Pro) to the data link connector.
- (7) Turn the ignition switch to ON and check the vehicle again.

Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

**YES**

Go to next step.

**NO**

Replace SAB module.

### 4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Restraint > Troubleshooting > B2503 Warning Lamp Open or Short to Ground

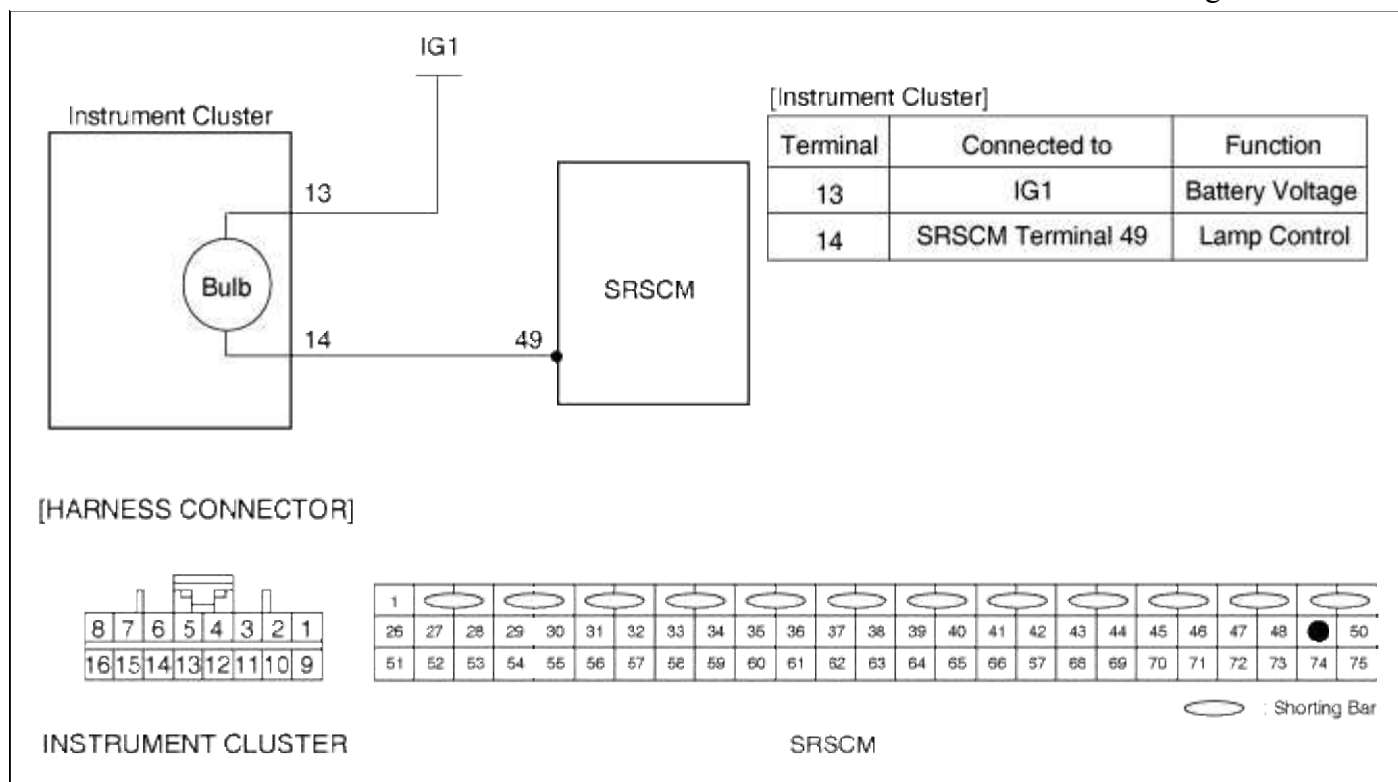
##### DTC Description

The SRS warning lamp is located in the cluster. When the airbag system is normal, the SRS warning lamp turns on for approx. 6 seconds after the ignition switch is turned to ON, and then turns off automatically. If there is a malfunction in the airbag system, the SRS warning lamp lights up to inform the driver of the abnormality. The SRSCM shall measure the voltage at the SRS warning lamp output pin, both when the lamp is on and when the lamp is off, to detect whether the commanded state matches the actual state.

##### DTC Detecting Condition

DTC	Condition	Probable cause
B2503 B2504	<ul style="list-style-type: none"> <li>• Airbag fuse</li> <li>• Warning Lamp Bulb</li> <li>• Open between warning lamp and SRSCM</li> <li>• Short to ground or battery line between the warning lamp and SRSCM</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Fuse</li> <li>• Warning lamp bulb</li> <li>• Wiring Harness</li> <li>• SRSCM</li> </ul>

##### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK THE FUSE

- (1) Remove the airbag fuse and the airbag warning lamp fuse from junction box.
- (2) Inspect the fuses. Are the fuses normal?

**YES**

Check the warning lamp bulb.

**NO**

Repair or replace the fuses.

#### 3. CHECK THE WARNING LAMP BULB

- (1) Remove the bulb from the instrument cluster.
- (2) Inspect the bulb. Is the bulb normal?

**YES**

Check source voltage.

**NO**

Repair or replace the bulb.

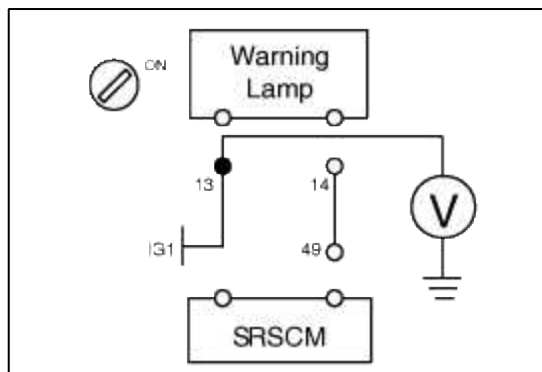
#### 4. CHECK SOURCE VOLTAGE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 13 of the Instrument Cluster harness connector and chassis ground.

---

Specification (voltage) : 9 ~ 16 V

---



- (4) Is the measured voltage within specification?

**YES**

Check short to battery line.

**NO**

Repair or replace the wiring harness between ignition switch and the Warning Lamp.

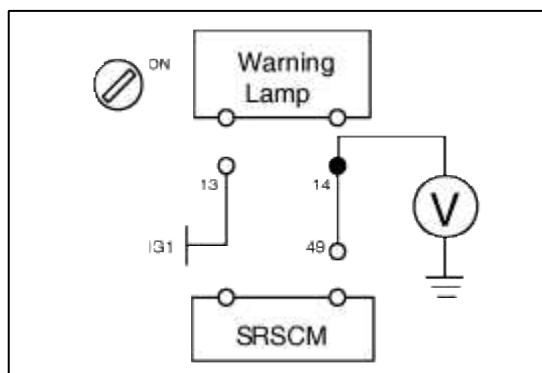
#### 5. CHECK SHORT TO BATTERY LINE

- (1) Measure voltage between the terminal 14 of the Instrument Cluster harness connector and chassis ground.

---

Specification (voltage) : Approximately 0 V

---



- (2) Is the measured voltage within specification?

**YES**

Check short or short to ground.

**NO**

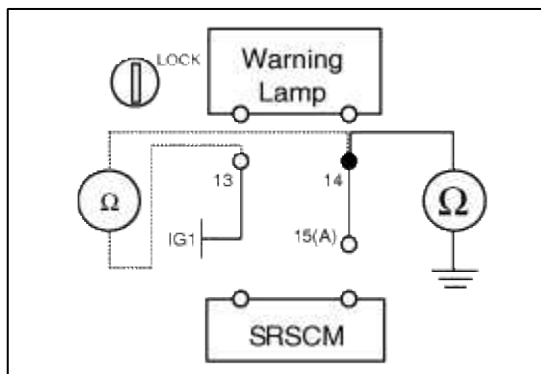
Repair the short to battery line circuit on wiring harness between the SRSCM and the Warning Lamp.



## 6. CHECK SHORT OR SHORT TO GROUND

- (1) Turn the ignition switch to LOCK.
- (2) Disconnect the battery negative cable from the battery.
- (3) Measure resistance between the terminal 14 of the Instrument Cluster harness connector and chassis ground.
- (4) Measure resistance between the terminal 13 and 14 of the Instrument Cluster harness connector.

Specification (resistance) : infinite



- (5) Is the measured resistance within specification?

**YES**

Check open circuit.

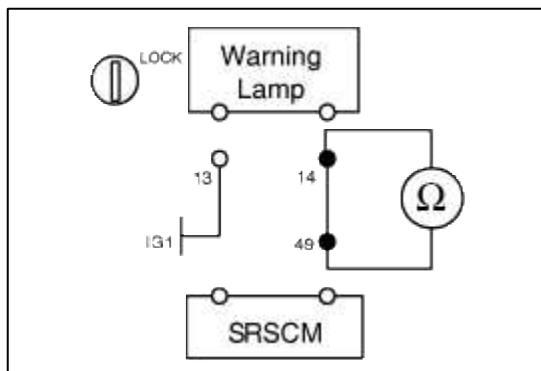
**NO**

Repair the short or short to ground circuit on wiring harness between the SRSCM and the Warning Lamp.

## 7. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 14 of the Instrument Cluster connector and the terminal 49 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair the open circuit on wiring harness between the SRSCM and the Warning Lamp.

## 8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

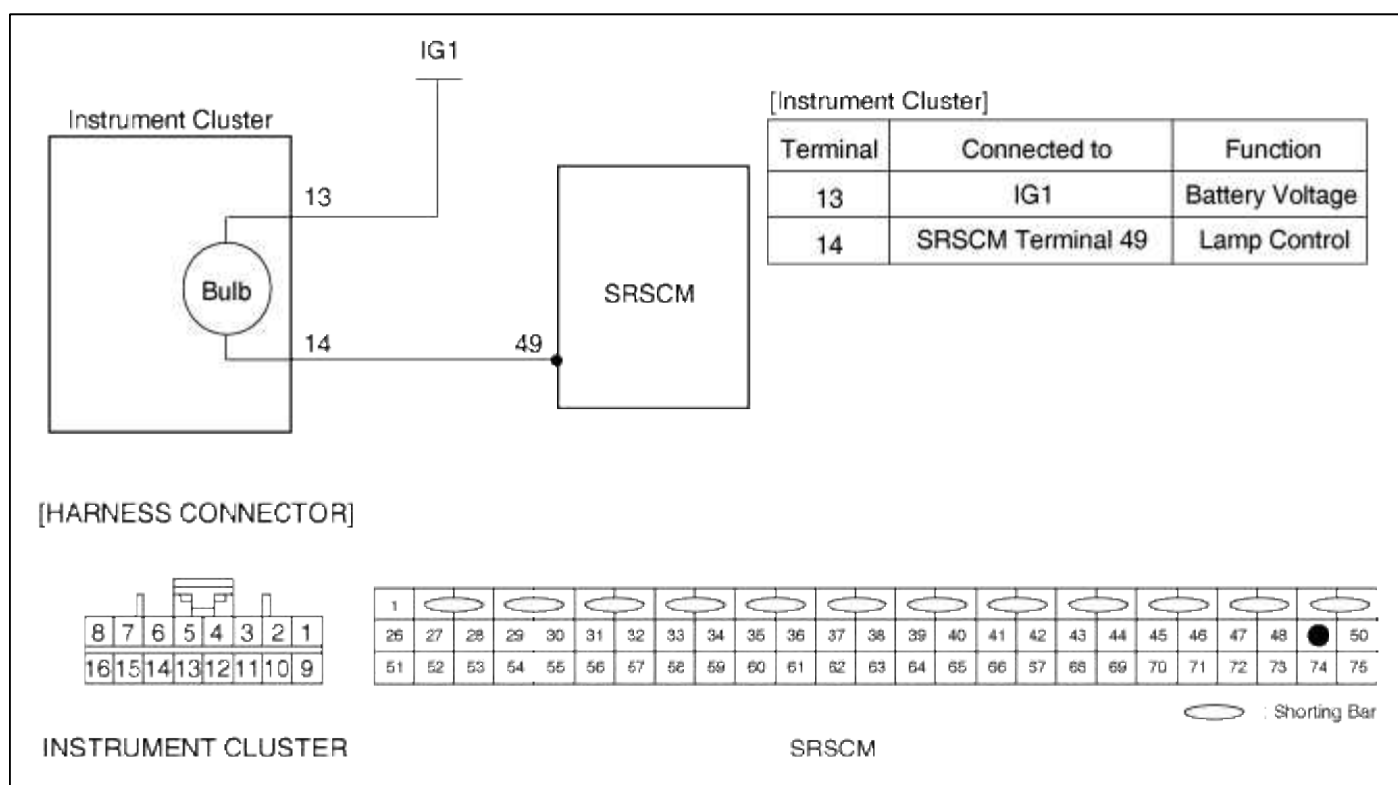
## DTC Description

The SRS warning lamp is located in the cluster. When the airbag system is normal, the SRS warning lamp turns on for approx. 6 seconds after the ignition switch is turned to ON, and then turns off automatically. If there is a malfunction in the airbag system, the SRS warning lamp lights up to inform the driver of the abnormality. The SRSCM shall measure the voltage at the SRS warning lamp output pin, both when the lamp is on and when the lamp is off, to detect whether the commanded state matches the actual state.

## DTC Detecting Condition

DTC	Condition	Probable cause
B2503 B2504	<ul style="list-style-type: none"> <li>• Airbag fuse</li> <li>• Warning Lamp Bulb</li> <li>• Open between warning lamp and SRSCM</li> <li>• Short to ground or battery line between the warning lamp and SRSCM</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Fuse</li> <li>• Warning lamp bulb</li> <li>• Wiring Harness</li> <li>• SRSCM</li> </ul>

## Schematic Diagram



## Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## Inspection Procedure

### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK THE FUSE

(1) Remove the airbag fuse and the airbag warning lamp fuse from junction box.

(2) Inspect the fuses. Are the fuses normal?

**YES**

Check the warning lamp bulb.

**NO**

Repair or replace the fuses.

## 3. CHECK THE WARNING LAMP BULB

(1) Remove the bulb from the instrument cluster.

(2) Inspect the bulb. Is the bulb normal?

**YES**

Check source voltage.

**NO**

Repair or replace the bulb.

## 4. CHECK SOURCE VOLTAGE

(1) Connect the battery negative cable to the battery.

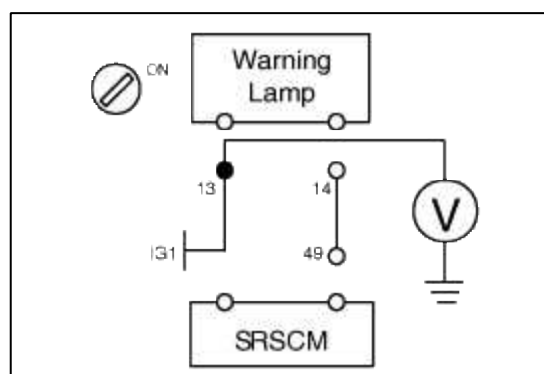
(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 13 of the Instrument Cluster harness connector and chassis ground.

---

Specification (voltage) : 9 ~ 16 V

---



(4) Is the measured voltage within specification?

**YES**

Check short to battery line.

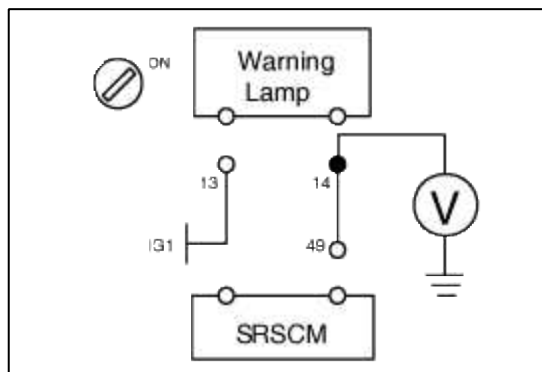
**NO**

Repair or replace the wiring harness between ignition switch and the Warning Lamp.

## 5. CHECK SHORT TO BATTERY LINE

- (1) Measure voltage between the terminal 14 of the Instrument Cluster harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



- (2) Is the measured voltage within specification?

**YES**

Check short or short to ground.

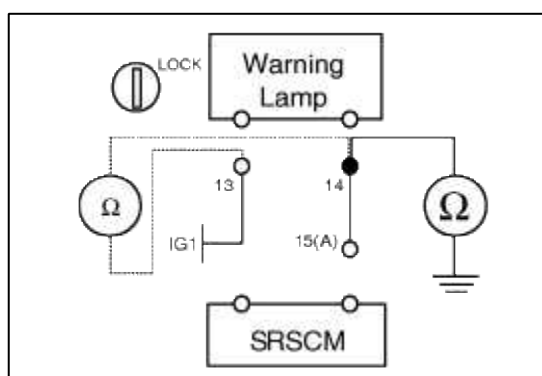
**NO**

Repair the short to battery line circuit on wiring harness between the SRSCM and the Warning Lamp.

## 6. CHECK SHORT OR SHORT TO GROUND

- (1) Turn the ignition switch to LOCK.  
 (2) Disconnect the battery negative cable from the battery.  
 (3) Measure resistance between the terminal 14 of the Instrument Cluster harness connector and chassis ground.  
 (4) Measure resistance between the terminal 13 and 14 of the Instrument Cluster harness connector.

Specification (resistance) : infinite



- (5) Is the measured resistance within specification?

**YES**

Check open circuit.

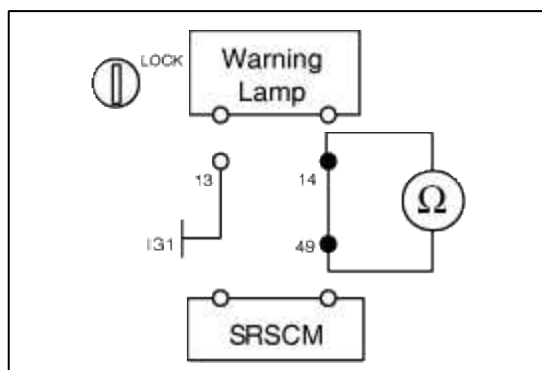
**NO**

Repair the short or short to ground circuit on wiring harness between the SRSCM and the Warning Lamp.

## 7. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 14 of the Instrument Cluster connector and the terminal 49 of SRSCM harness connector.

Specification (resistance) : below 1  $\Omega$



- (2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair the open circuit on wiring harness between the SRSCM and the Warning Lamp.

## 8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Restraint > Troubleshooting > B2507 Passenger airbag Telltale lamp Circuit open or short to ground

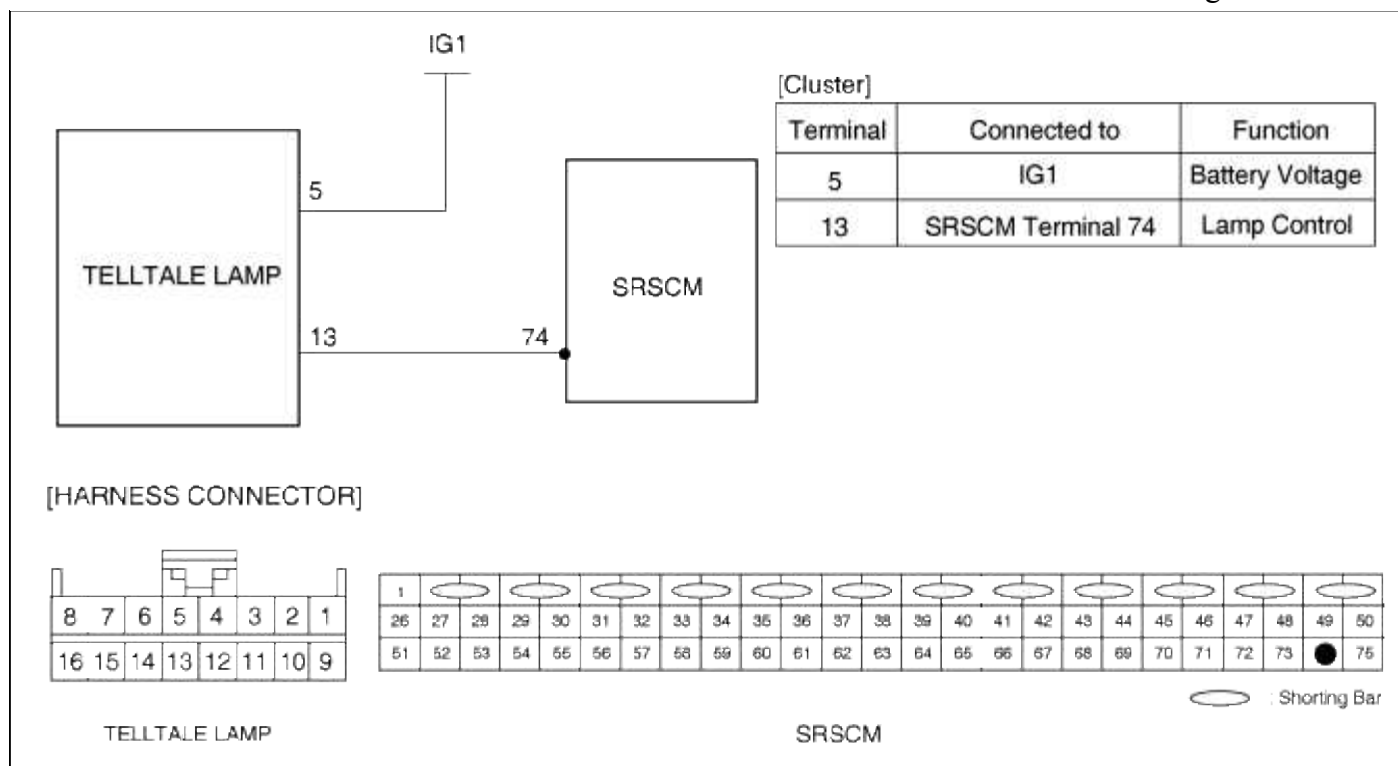
#### DTC Description

The Telltale Lamp circuit consists of the Telltale Lamp and the SRSCM. SRSCM sets the above DTC if the Telltale Lamp failure is detected.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B2507 B2508	<ul style="list-style-type: none"> <li>Airbag fuse</li> <li>Telltale Lamp Bulb</li> <li>Open between Telltale Lamp and SRSCM</li> <li>Short to ground or battery line between the Telltale Lamp and SRSCM</li> <li>SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>Fuse</li> <li>Telltale Lamp Bulb</li> <li>Wiring Harness</li> <li>SRSCM</li> </ul>

#### Schematic Diagram



### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

### Inspection Procedure

#### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### 2. CHECK THE FUSE

(1) Remove the airbag fuse and the airbag telltale lamp fuse from junction block.

(2) Inspect the fuses. Are the fuses normal?

**YES**

Check the telltale lamp bulb.

**NO**

Repair or replace the fuses.

#### 3. CHECK THE TELLTALE LAMP BULB

(1) Remove the bulb from the instrument cluster.

(2) Inspect the bulb. Is the bulb normal?

**YES**

Check source voltage.

**NO**

Repair or replace the bulb.

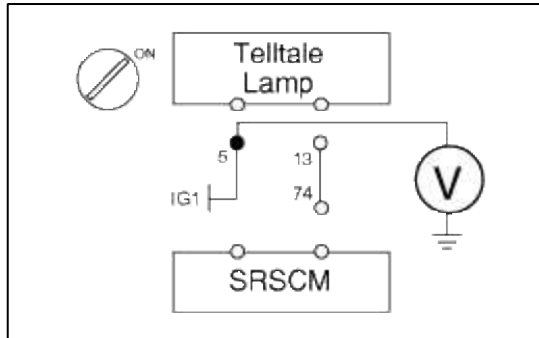
#### 4. CHECK SOURCE VOLTAGE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 5 of the Telltale Lamp harness connector and chassis ground.

---

specification(voltage) : 9 ~ 16 V

---



- (4) Is the measured voltage within specification?

**YES**

Check short to battery line.

**NO**

Repair or replace the wiring harness between ignition switch and the Telltale Lamp.

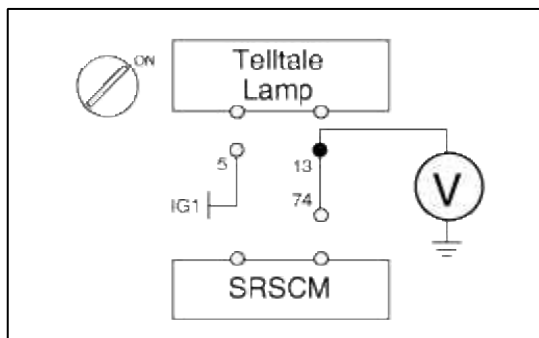
#### 5. CHECK SHORT TO BATTERY LINE

- (1) Measure voltage between the terminal 13 of the Telltale Lamp harness connector and chassis ground.

---

specification(voltage) : Approximately 0 V

---



- (2) Is the measured voltage within specification?

**YES**

Check short or short to ground.

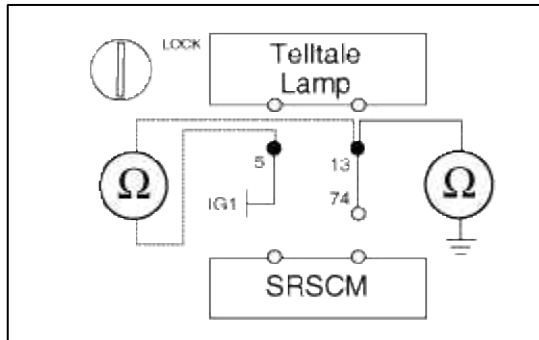
**NO**

Repair the short to battery line circuit on wiring harness between the SRSCM and the Telltale Lamp.

## 6. CHECK SHORT OR SHORT TO GROUND

- (1) Turn the ignition switch to LOCK.
- (2) Disconnect the battery negative cable from the battery.
- (3) Measure resistance between the terminal 13 of the Telltale Lamp harness connector and chassis ground.
- (4) Measure resistance between the terminal 5 and 13 of the Telltale Lamp harness connector.

specification(resistance) : infinite



- (5) Is the measured resistance within specification?

**YES**

Check open circuit.

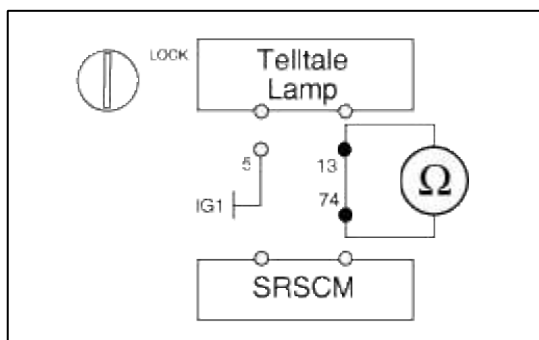
**NO**

Repair the short or short to ground circuit on wiring harness between the SRSCM and the Telltale Lamp.

## 7. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 13 of the Telltale Lamp harness connector and the terminal 74 of SRSCM harness connector.

specification(resistance) : below 1  $\Omega$



- (2) Is the measured resistance within specification?

**YES**

Go to next step.

**NO**

Repair the open circuit on wiring harness between the SRSCM and the Telltale Lamp.

## 8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

**Restraint > Troubleshooting > B2508 Passenger airbag Telltale lamp Circuit short or short to battery**

DTC Description

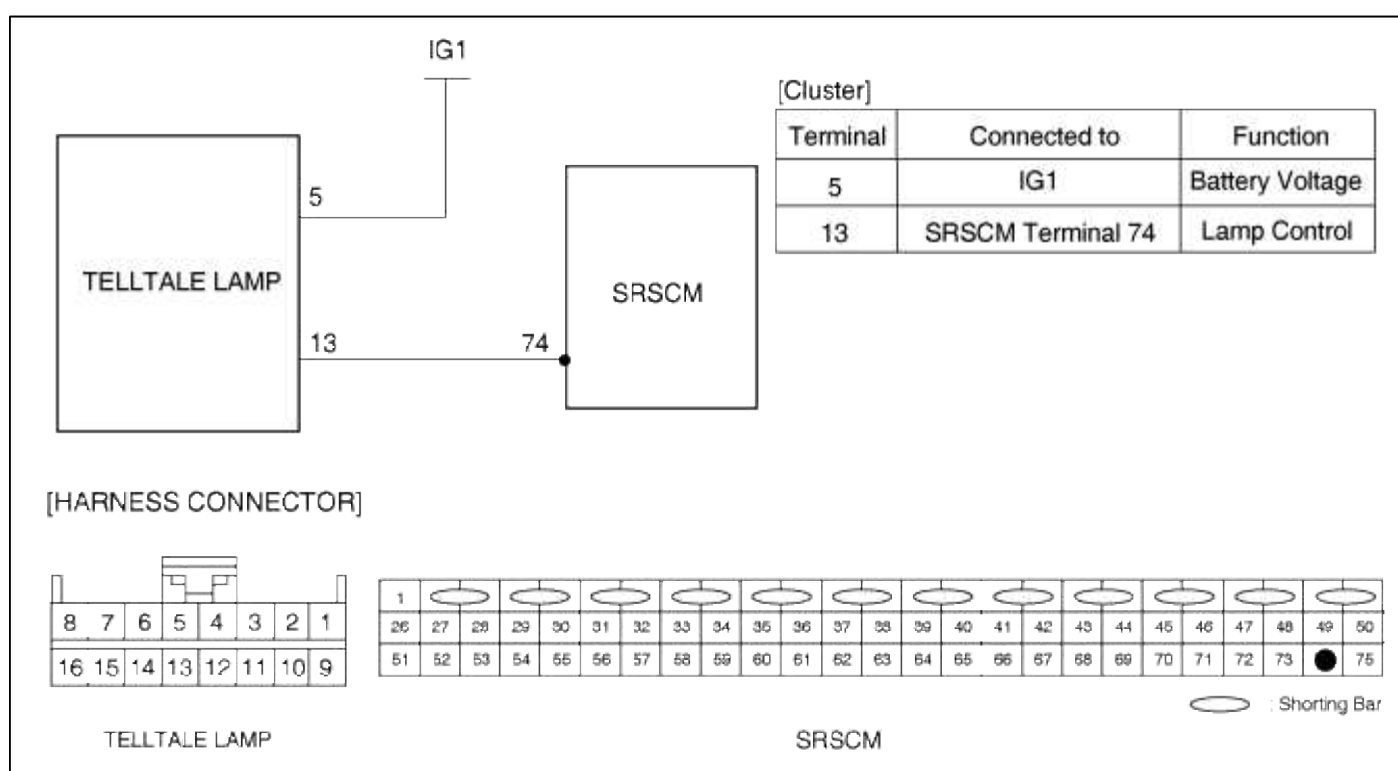


The Telltale Lamp circuit consists of the Telltale Lamp and the SRSCM. SRSCM sets the above DTC if the Telltale Lamp failure is detected.

#### DTC Detecting Condition

DTC	Condition	Probable cause
B2507 B2508	<ul style="list-style-type: none"> <li>• Airbag fuse</li> <li>• Telltale Lamp Bulb</li> <li>• Open between Telltale Lamp and SRSCM</li> <li>• Short to ground or battery line between the Telltale Lamp and SRSCM</li> <li>• SRSCM Malfunction</li> </ul>	<ul style="list-style-type: none"> <li>• Fuse</li> <li>• Telltale Lamp Bulb</li> <li>• Wiring Harness</li> <li>• SRSCM</li> </ul>

#### Schematic Diagram



#### Terminal & Connector Inspection

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

#### Inspection Procedure

##### 1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

## 2. CHECK THE FUSE

- (1) Remove the airbag fuse and the airbag telltale lamp fuse from junction block.
- (2) Inspect the fuses. Are the fuses normal?

**YES**

Check the telltale lamp bulb.

**NO**

Repair or replace the fuses.

## 3. CHECK THE TELLTALE LAMP BULB

- (1) Remove the bulb from the instrument cluster.
- (2) Inspect the bulb. Is the bulb normal?

**YES**

Check source voltage.

**NO**

Repair or replace the bulb.

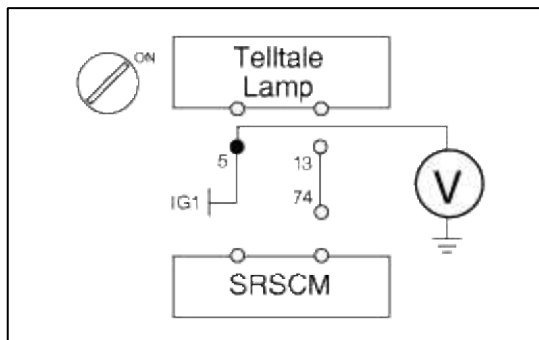
## 4. CHECK SOURCE VOLTAGE

- (1) Connect the battery negative cable to the battery.
- (2) Turn the ignition switch to ON.
- (3) Measure voltage between the terminal 5 of the Telltale Lamp harness connector and chassis ground.

---

 specification(voltage) : 9 ~ 16 V
 

---



- (4) Is the measured voltage within specification?

**YES**

Check short to battery line.

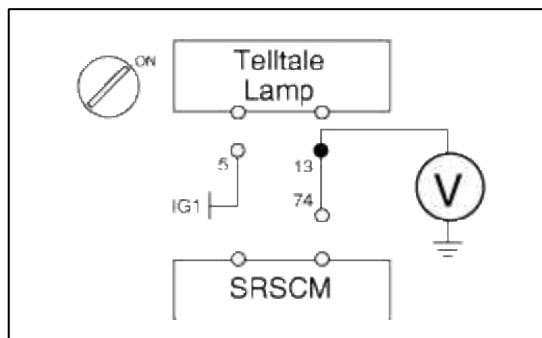
**NO**

Repair or replace the wiring harness between ignition switch and the Telltale Lamp.

## 5. CHECK SHORT TO BATTERY LINE

- (1) Measure voltage between the terminal 13 of the Telltale Lamp harness connector and chassis ground.

specification(voltage) : Approximately 0 V



- (2) Is the measured voltage within specification?

**YES**

Check short or short to ground.

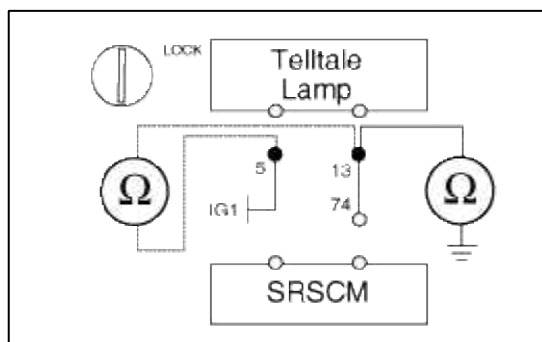
**NO**

Repair the short to battery line circuit on wiring harness between the SRSCM and the Telltale Lamp.

## 6. CHECK SHORT OR SHORT TO GROUND

- (1) Turn the ignition switch to LOCK.  
 (2) Disconnect the battery negative cable from the battery.  
 (3) Measure resistance between the terminal 13 of the Telltale Lamp harness connector and chassis ground.  
 (4) Measure resistance between the terminal 5 and 13 of the Telltale Lamp harness connector.

specification(resistance) : infinite



- (5) Is the measured resistance within specification?

**YES**

Check open circuit.

**NO**

Repair the short or short to ground circuit on wiring harness between the SRSCM and the Telltale Lamp.

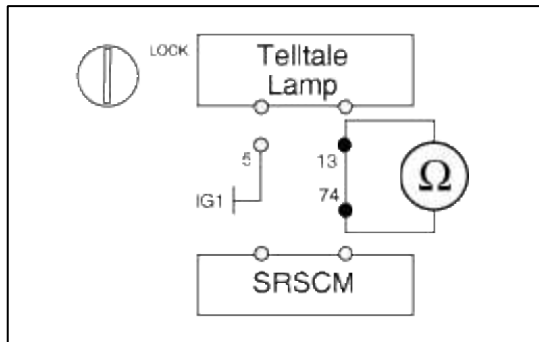
## 7. CHECK OPEN CIRCUIT

- (1) Measure resistance between the terminal 13 of the Telltale Lamp harness connector and the terminal 74 of SRSCM harness connector.

---

specification(resistance) : below 1  $\Omega$

---



- (2) Is the measured resistance within specification?

**YES**

Go to next step.

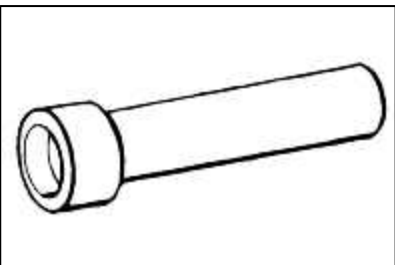
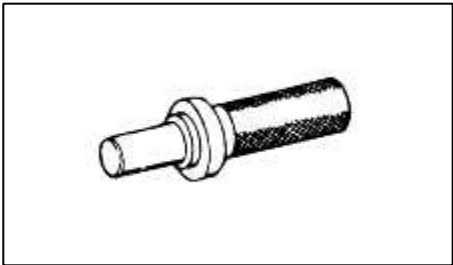
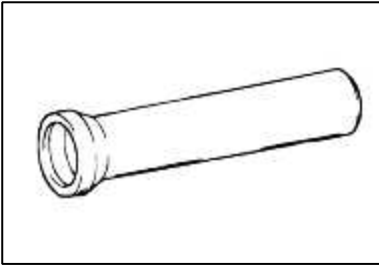
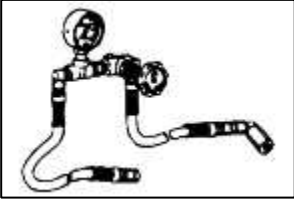


**NO**

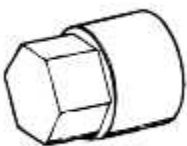

Repair the open circuit on wiring harness between the SRSCM and the Telltale Lamp.

## 8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

Refer to the DESCRIPTION in this TROUBLESHOOTING section.

**SORENTO(BL) > 2007 > G 3.3 DOHC > Steering System****Steering System > General Information > Special Service Tools****SPECIAL TOOLS**

<b>Tool (Number and name)</b>	<b>Illustration</b>	<b>Use</b>
Valve stem oil seal installer (09222 - 21100)		Installation of the pinion gear bearing
Front oil seal installer (09431 - 11000)		Installation of the pinion gear oil seal
Bearing installer (09432 - 21601)		Installation of the pinion gear bearing
Oil pressure gauge (09572-21000)		Measurement of the oil pump pressure
Power steering oil pressure gauge adapter (Pump side) (09572-33100)		
Power steering oil pressure gauge adapter (Hose side) (09572-21200)		

Yoke plug torque wrench socket (09565 - 31300)		Removal, installation and adjustment of steering gear yoke plug
Ball joint remover (0K670 - 321 - 019)		Separation of the tie rod end ball joint

### Steering System > General Information > Troubleshooting

#### TROUBLESHOOTING

Symptom	Probable cause	Remedy
Steering wheel return malfunction	Incorrect tire pressure	Adjust the tire pressure
Steering operation is "hard"	Incorrect tire pressure	Adjust the tire pressure
	Loose belt	Adjust the belt tension
	Damaged belt	Replace the belt
	Low fluid level	Refill fluid
	Air in fluid line	Bleed the system
Steering wheel pulls to one side	Twisted hose	Correct the hose routing or replace the hoses
	Incorrect mounting of the steering gear box on the crossmember	Retighten
	Fluid leakage	Check the fluid leakage and retighten or replace
	Incorrect wheel alignment (especially caster)	Adjust the wheel alignment
	Malfunction of gear box	Check and replace the gear box if necessary
	Malfunction of oil pump	Check the oil pump pressure and repair oil pump
	Excessive steering wheel play	Adjust the steering wheel play
	Insufficient tire inflation pressure	Adjust the tire pressure
	Unevenly worn or deformed tire	Rotate the wheel or replace the tire
	Dragging brake	Adjust

	Deteriorated or broken front spring	Replace
	Deformed knuckle arm	Replace
	Poor wheel alignment	Adjust the wheel alignment
	Damaged wheel bearing	Replace
	Deformed or loose lower arm	Retighten or replace
	Loose linkage joints	Retighten
	Malfunction of ball joints (Too small ball joint starting torque)	Replace
	Deteriorated or broken lower arm bushing	Replace
	Incorrect installation or internal damage in gear	Correct or replace
	Malfunction of shock absorber	Replace
Steering wheel vibrates	Insufficient tire inflation pressure	Adjust the tire pressure
	Unevenly worn or deformed tire(s)	Rotate the wheels or replace the tire(s)
	Loose hub nut	Retighten
	Excessive runout, or unbalance of tire and wheel	Adjust the wheel balance or replace
	Poor wheel alignment	Adjust the wheel alignment
	Damaged wheel bearing	Replace
	Deformed or loose lower arm	Retighten or replace
	Deformed linkage	Repair or replace
	Loose linkage joints	Retighten
	Malfunction of ball joints (Too small ball joint starting torque)	Replace
	Malfunction of front suspension	Check and adjust; replace the parts if necessary
	Incorrect installation or internal damage in gear box	Correct or replace
	Malfunctioning of shock absorber	Replace
Road shock is felt in steering wheel	Insufficient steering wheel play	Adjust the steering wheel play
	Insufficient tire inflation pressure	Adjust the tire pressure
	Unevenly worn or deformed tire(s)	Rotate the wheels or replace the tire(s)
	Malfunction of shock absorber	Replace
Poor recovery of steering wheel to straight ahead position	Insufficient tire inflation pressure	Adjust the tire pressure
	Stuck or damaged ball joint	Replace
	Improper wheel alignment angles	Adjust the wheel alignment
Rattling noise	Loose installation of oil pump or gear box	Retighten the oil pump and gear box

	Steering linkage looseness or play	Retighten or replace the steering linkage
	Loose oil pump pulley nut	Retighten the oil pump pulley nut
	Interference around column or between pressure hose and other parts	Correct or replace the pressure hose and the parts around the column
	Abnormal noise inside the gear box and oil pump	Replace the gear box or oil pump
Strident noise	Air sucked into oil pump	Check the oil level and hose clips bleed the system or replace the oil pump
	Seizure inside oil pump	Replace the oil pump
Squealing noise 1)	Loose belt	Adjust the belt tension
	Seizure inside oil pump	Replace the oil pump
Hissing noise	Air sucked into oil pump	Check the oil level and hose clips; bleed the system
	Damage to the gear box port section	Replace the gear box
	Malfunction of return hose	Replace the hose
Whistling noise	Malfunction of gear box port section	Replace the gear box
Droning noise	Loose mounting bolt on oil pump or oil pump bracket	Retighten the pump bracket and pump installing bolt
	Poor condition of oil pump body 2)	Replace the oil pump
Squealing noise 2)	Malfunction of steering stopper contact	Check and adjust the steering stopper
	Interference of wheel with vehicle body	Adjust the steering angle
	Interference of steering shaft and joint assembly with other parts	Reposition the interfering parts
	Malfunction of gear box	Replace the gear box
Shuddering vibration 3)	Air suction	Bleed the system
	Malfunction of gear box	Replace the gear box
Oil leakage from hose connection	Improperly tightened flare nut	Check, repair or replace
	Incorrectly inserted hose	
	Improperly clamped hose	
Oil leakage from hose assembly	Damaged or clogged hose	Replace
	Hose connector malfunction	
Oil leakage from oil reservoir	Leaking reservoir	Replace
	Overflow	Bleed the system or adjust the oil level
Oil leakage from oil pump	Malfunction of oil pump housing	Replace the oil pump
	Malfunction of O-ring and/or oil seal	Replace the O-ring and oil seal



Oil leakage from gear box	Malfunction of gear box housing (including leakage from air hole)	Replace the gear box
	Malfunction of O-ring and/or oil seal	Replace the O-ring and oil seal

**NOTE**

1. A squealing noise may be heard just after very cold engine start (-20°C or less), caused by fluid characteristics at extreme low temperatures. This is not a malfunction.
2. A slight "beat noise" is produced by the oil pump; this is not a malfunction. (This noise occurs particularly when a stationary steering effort is made.)
3. A slight vibration may be felt when a stationary steering effort is made due to the condition of the road surface. To check whether the vibration actually exists or not, test-drive the vehicle on a dry concrete or asphalt surface. A very slight amount of vibration is not a malfunction.

**TROUBLESHOOTING**

Symptom	Probable cause	Remedy
Steering wheel return malfunction	Incorrect tire pressure	Adjust the tire pressure
Steering operation is "hard"	Incorrect tire pressure	Adjust the tire pressure
	Loose belt	Adjust the belt tension
	Damaged belt	Replace the belt
	Low fluid level	Refill fluid
	Air in fluid line	Bleed the system
Steering wheel pulls to one side	Twisted hose	Correct the hose routing or replace the hoses
	Incorrect mounting of the steering gear box on the crossmember	Retighten
	Fluid leakage	Check the fluid leakage and retighten or replace
	Incorrect wheel alignment (especially caster)	Adjust the wheel alignment
	Malfunction of gear box	Check and replace the gear box if necessary
	Malfunction of oil pump	Check the oil pump pressure and repair oil pump
	Excessive steering wheel play	Adjust the steering wheel play
	Insufficient tire inflation pressure	Adjust the tire pressure
	Unevenly worn or deformed tire	Rotate the wheel or replace the tire
	Dragging brake	Adjust
	Deteriorated or broken front spring	Replace
	Deformed knuckle arm	Replace
	Poor wheel alignment	Adjust the wheel alignment

	Damaged wheel bearing	Replace
	Deformed or loose lower arm	Retighten or replace
	Loose linkage joints	Retighten
	Malfunction of ball joints (Too small ball joint starting torque)	Replace
	Deteriorated or broken lower arm bushing	Replace
	Incorrect installation or internal damage in gear	Correct or replace
	Malfunction of shock absorber	Replace
Steering wheel vibrates	Insufficient tire inflation pressure	Adjust the tire pressure
	Unevenly worn or deformed tire(s)	Rotate the wheels or replace the tire(s)
	Loose hub nut	Retighten
	Excessive runout, or unbalance of tire and wheel	Adjust the wheel balance or replace
	Poor wheel alignment	Adjust the wheel alignment
	Damaged wheel bearing	Replace
	Deformed or loose lower arm	Retighten or replace
	Deformed linkage	Repair or replace
	Loose linkage joints	Retighten
	Malfunction of ball joints (Too small ball joint starting torque)	Replace
	Malfunction of front suspension	Check and adjust; replace the parts if necessary
	Incorrect installation or internal damage in gear box	Correct or replace
	Malfunctioning of shock absorber	Replace
Road shock is felt in steering wheel	Insufficient steering wheel play	Adjust the steering wheel play
	Insufficient tire inflation pressure	Adjust the tire pressure
	Unevenly worn or deformed tire(s)	Rotate the wheels or replace the tire(s)
	Malfunction of shock absorber	Replace
Poor recovery of steering wheel to straight ahead position	Insufficient tire inflation pressure	Adjust the tire pressure
	Stuck or damaged ball joint	Replace
	Improper wheel alignment angles	Adjust the wheel alignment
Rattling noise	Loose installation of oil pump or gear box	Retighten the oil pump and gear box
	Steering linkage looseness or play	Retighten or replace the steering linkage
	Loose oil pump pulley nut	Retighten the oil pump pulley nut

	Interference around column or between pressure hose and other parts	Correct or replace the pressure hose and the parts around the column
	Abnormal noise inside the gear box and oil pump	Replace the gear box or oil pump
Strident noise	Air sucked into oil pump	Check the oil level and hose clips bleed the system or replace the oil pump
	Seizure inside oil pump	Replace the oil pump
Squealing noise 1)	Loose belt	Adjust the belt tension
	Seizure inside oil pump	Replace the oil pump
Hissing noise	Air sucked into oil pump	Check the oil level and hose clips; bleed the system
	Damage to the gear box port section	Replace the gear box
	Malfunction of return hose	Replace the hose
Whistling noise	Malfunction of gear box port section	Replace the gear box
Droning noise	Loose mounting bolt on oil pump or oil pump bracket	Retighten the pump bracket and pump installing bolt
	Poor condition of oil pump body 2)	Replace the oil pump
Squealing noise 2)	Malfunction of steering stopper contact	Check and adjust the steering stopper
	Interference of wheel with vehicle body	Adjust the steering angle
	Interference of steering shaft and joint assembly with other parts	Reposition the interfering parts
	Malfunction of gear box	Replace the gear box
Shuddering vibration 3)	Air suction	Bleed the system
	Malfunction of gear box	Replace the gear box
Oil leakage from hose connection	Improperly tightened flare nut	Check, repair or replace
	Incorrectly inserted hose	
	Improperly clamped hose	
Oil leakage from hose assembly	Damaged or clogged hose	Replace
	Hose connector malfunction	
Oil leakage from oil reservoir	Leaking reservoir	Replace
	Overflow	Bleed the system or adjust the oil level
Oil leakage from oil pump	Malfunction of oil pump housing	Replace the oil pump
	Malfunction of O-ring and/or oil seal	Replace the O-ring and oil seal
Oil leakage from gear box	Malfunction of gear box housing (including leakage from air hole)	Replace the gear box
	Malfunction of O-ring and/or oil seal	Replace the O-ring and oil seal

**NOTE**

1. A squealing noise may be heard just after very cold engine start ( $-20^{\circ}\text{C}$  or less), caused by fluid characteristics at extreme low temperatures. This is not a malfunction.
2. A slight "beat noise" is produced by the oil pump; this is not a malfunction. (This noise occurs particularly when a stationary steering effort is made.)
3. A slight vibration may be felt when a stationary steering effort is made due to the condition of the road surface. To check whether the vibration actually exists or not, test-drive the vehicle on a dry concrete or asphalt surface. A very slight amount of vibration is not a malfunction.

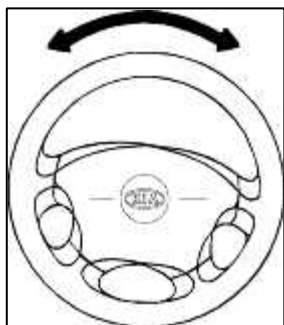
**Steering System > General Information > Repair procedures****SERVICE ADJUSTMENT PROCEDURES****STEERING WHEEL FREE PLAY CHECK**

1. With the engine stationary and the steering wheel in the straight-ahead position, apply a force of 0.5 kg (1.1 lbs.) to the steering wheel in the peripheral direction.

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Standard value : 30 mm or less

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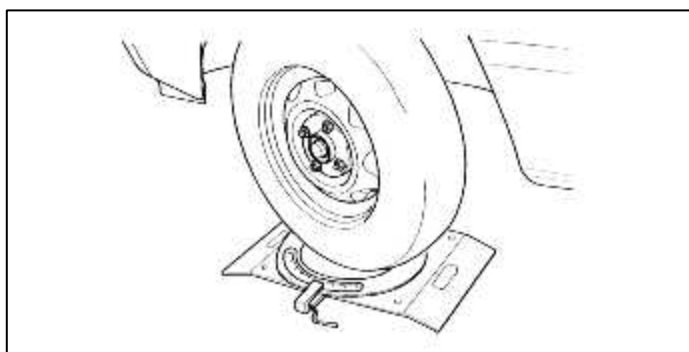
2. If the measured value exceeds the standard value. Inspect contact of the steering shaft and tie rod ball joints.

**STEERING ANGLE CHECK**

1. Place the front wheel on a turning radius gauge and measure the steering angle.

**STANDARD VALUE**

Item	2WD	4WD
Inner wheel	$36.94^{\circ} \pm 2^{\circ}$	$37.15^{\circ} \pm 2^{\circ}$
Outer wheel	$32.02^{\circ} \pm 2^{\circ}$	$32.05^{\circ} \pm 2^{\circ}$



2. If the measured value is not within the standard value, adjust the toe-in and inspect again.

**NOTE**

After adjusting the tie rod, assemble the bellows so they are not twisted.

### STATIONARY STEERING EFFORT CHECK (POWER STEERING)

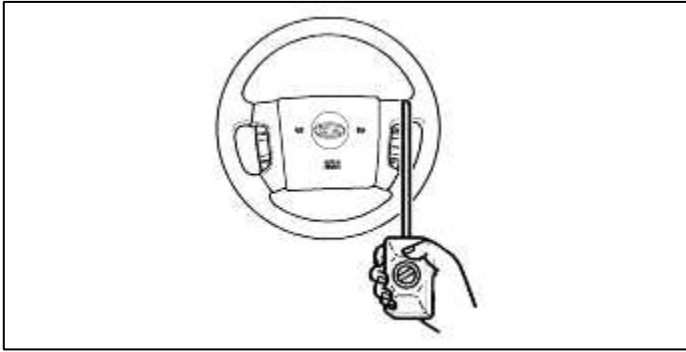
1. Place the vehicle on a level surface and place the steering wheel in the straight-ahead position.
2. Set the engine speed to 1,000 rpm.
3. Measure the tangential force with a spring balance by turning the steering wheel clockwise and counterclockwise one and a half turns.

---

Standard value : 3.3 kg (7.31 lbs) or less

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4. If the stationary steering effort exceeds the standard value, check for belt slackness, damage, insufficient oil, air mixed into oil, collapsed or twisted hoses, etc., and repair if found.



### CHECKING OF THE STEERING WHEEL RETURN TO CENTER (POWER STEERING)

To check for the return of steering wheel to Center, carry out drive test and check the following points.

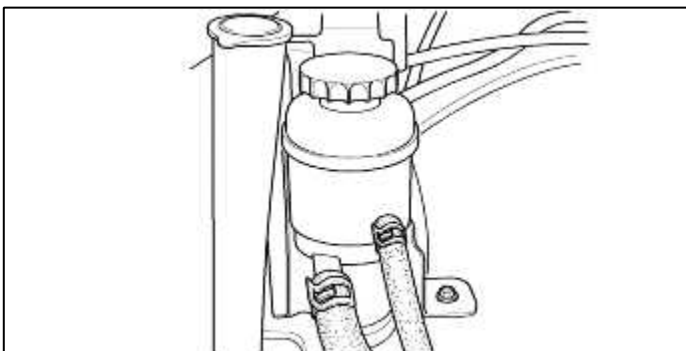
1. Make gentle and sharp turns and check to get a feel for that there is no appreciable difference in steering effort and return to Center between right and left turns.
2. Drive at a speed of about 35 km/h turn the steering wheel 90° clockwise or counterclockwise, and release the wheel a second or two later, if the wheel returns more than 70°, the return may be considered good.

#### NOTE

When the steering wheel is turned abruptly, momentary hard steering might result, but this does not mean any problem. It is caused by low oil pump delivery during idling.

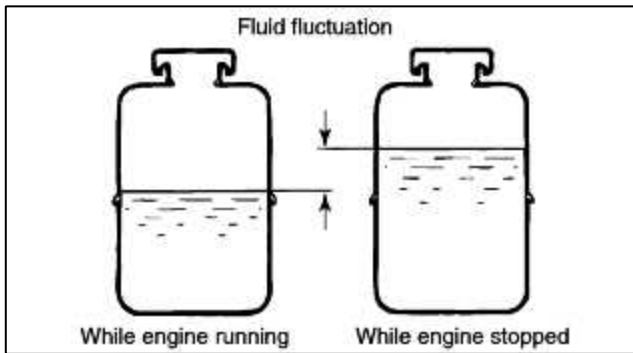
### FLUID LEVEL CHECK (POWER STEERING)

1. Park the vehicle on a flat, level surface, start the engine, and then turn the steering wheel several times to raise the temperature of the fluid to approximately 50° - 60° C.



2. With the engine running, turn the wheel all the way to the left and right several times.
3. Check the fluid in the oil reservoir for foaming or milkiness.

4. Check the difference of the fluid level when the engine is stopped, and while it is running. If the fluid level changes considerably, air bleedingshould be done.



#### FLUID REPLACEMENT (POWER STEERING)

1. Raise the front wheels on a jack, and then support them with rigid racks.
2. Disconnect the return hose connection.
3. Connect a vinyl hose to the return hose, and drain the oil into a container.
4. On vehicles with a patrol engine, disconnect the high tension cable. On vehicles with a diesel engine, remove the fuel cut valve connector attachedto the injection pump.  
While operating the starter motor intermittently, turn the steering wheel all the way to the left and right several times to drain all of thefluid.
5. Connect the return hoses securely, and then secure it with the clip.
6. Fill the oil reservoir with the specified fluid up to the lower position of the filter, and then bleed the air.

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Specified fluid : PSF-III

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#### BLEEDING

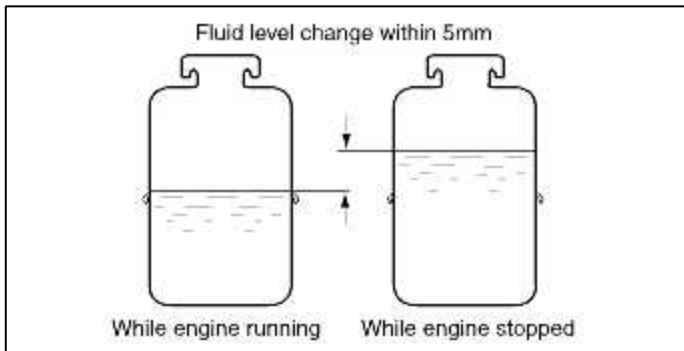
1. Jack up the front wheels and support them by using a rigid rack.
2. Manually turn the oil pump pulley a few times.
3. Turn the steering wheel all the way to the left and to the right five or six times.
4. On vehicles with a patrol engine, disconnect the high tension cable. On vehicles with a diesel engine, remove the fuel cut valve connector attachedto the injection pump.  
While operating the starter motor intermittently, turn the steering wheel all the way to the left and right five or six times (for 15 to 20 seconds).

#### CAUTION

- During air bleeding, replenish the fluid supply so that the level never falls below the lower position of the filter.
- If air bleeding is done while engine is running, the air will be broken up and absorbed into the fluid; be sure to do the bleeding only while cranking.

5. On vehicles with a patrol engine, connect the ignition cable. On vehicles with a diesel engine, connect the fuel cut valve connector attached to theinjection pump. Start the engine (idling).
6. Turn the steering wheel to the left and right until there are no air bubbles in the oil reservoir.
7. Confirm that the fluid is not milky, and that the level is up to the specified position on the level gauge.
8. Confirm that there is very little change in the fluid level when the steering wheel is turned left and right.

9. Check whether or not the change in the fluid level is within 5 mm (0.20 in.) when the engine is stopped and when it is running.



#### CAUTION

- If the change of the fluid level is 5 mm (0.20 in.) or more, the air has not been completely bled from the system, and thus must be bled completely.
- If the fluid level rises suddenly after the engine is stopped, the air has not been completely bled.
- If air bleeding is not complete, there will be abnormal noises from the pump and the flow-control valve, and this condition could cause a lessening of the life of the pump, etc.

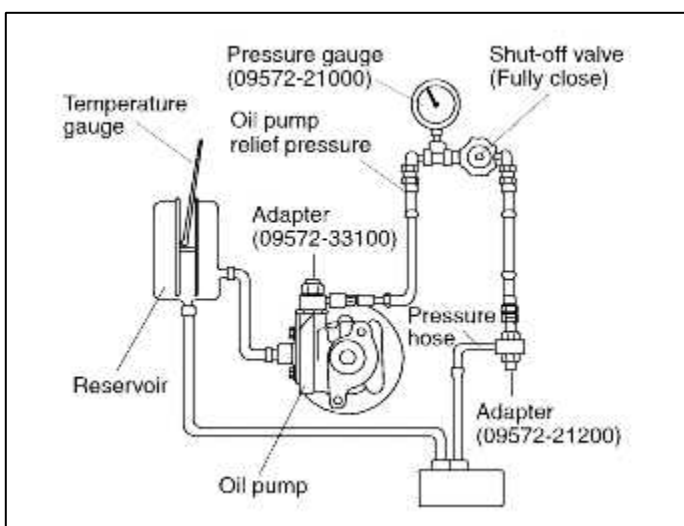
#### OIL PUMP PRESSURE TEST CHECKING THE OIL PUMP RELIEF PRESSURE

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50-60° C (122-140° F).
3. Start the engine and idle it at  $1,000 \pm 100$  rpm.
4. Fully close the shut-off valve of the pressure gauge and measure the oil pump relief pressure to confirm that it is within the standard value range.

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Standard value : 89 - 95 kg/cm<sup>2</sup> (1,265 - 1,351 psi)

---



#### CAUTION

Pressure gauge shut off valve must not remain closed for more than 10 seconds.

5. If it is not within the standard value, replace the oil pump.

6. Remove the special tools, and then tighten the pressure hose to the specified torque.

Tightening Torque:

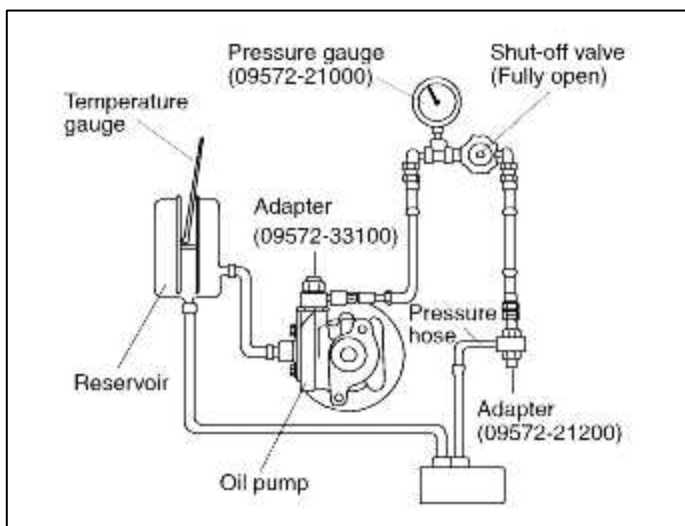
55 - 65 N·m (5.5- 6.5 kg-m, 39 - 47 lb-ft)

7. Bleed the system.

#### CHECKING THE PRESSURE UNDER NO-LOAD CONDITIONS

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid raise to approximately 50-60° C (122-140° F).
3. Start the engine and idle it at  $1,000 \pm 100$  rpm.
4. Check whether or not the hydraulic pressure is the standard value when no-load conditions are created by fully opening the shut-off valve of the pressure gauge.

Standard value : 4 - 6 kg/cm<sup>2</sup> (56 - 85 psi)



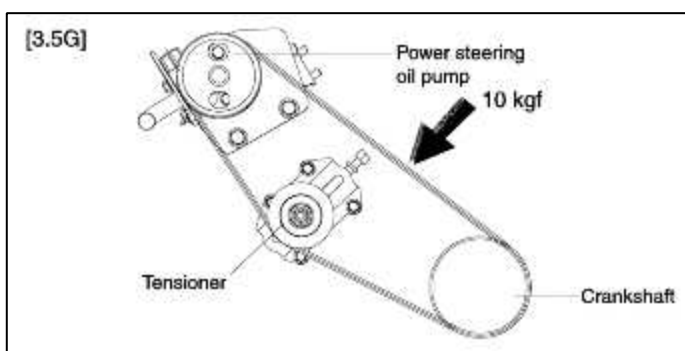
5. If it is not within the standard value, the probable cause is a malfunction of the oil line or steering gear box, so check these parts and repair as necessary.
6. Remove the special tools, and then tighten the pressure hose to the specified torque.
7. Bleed the system.

#### CHECKING POWER STEERING BELT TENSION

1. Press the V-belt, applying a pressure of 98 N (10 kg, 22 lb) at the specified point, and measure the deflection to confirm that it is within the standard value range.

V-belt deflection [Standard value]

6 - 7 mm (0.236 - 0.275 in.)



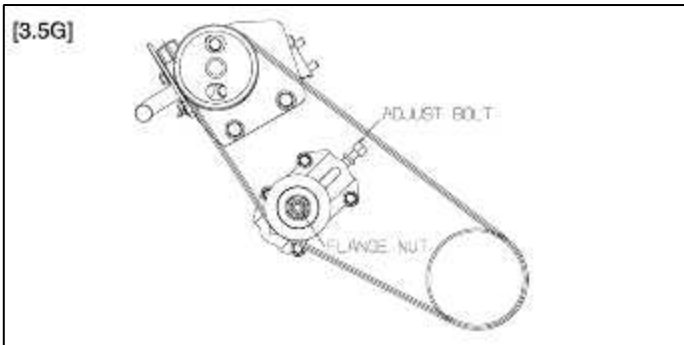


2. Install the belt. Loosen the adjusting bolt A or flange nut and then adjust the tension of the belt with adjusting bolt B.

After that, tighten the adjusting bolt or flange nut to the specified value.

#### NOTE

- When adjusting tension of the belt, tighten the adjusting bolt and flange nut temporarily so that the pulley does not lean to one side, then adjust the tension.



### Steering System > General Information > Specifications

#### SPECIFICATIONS

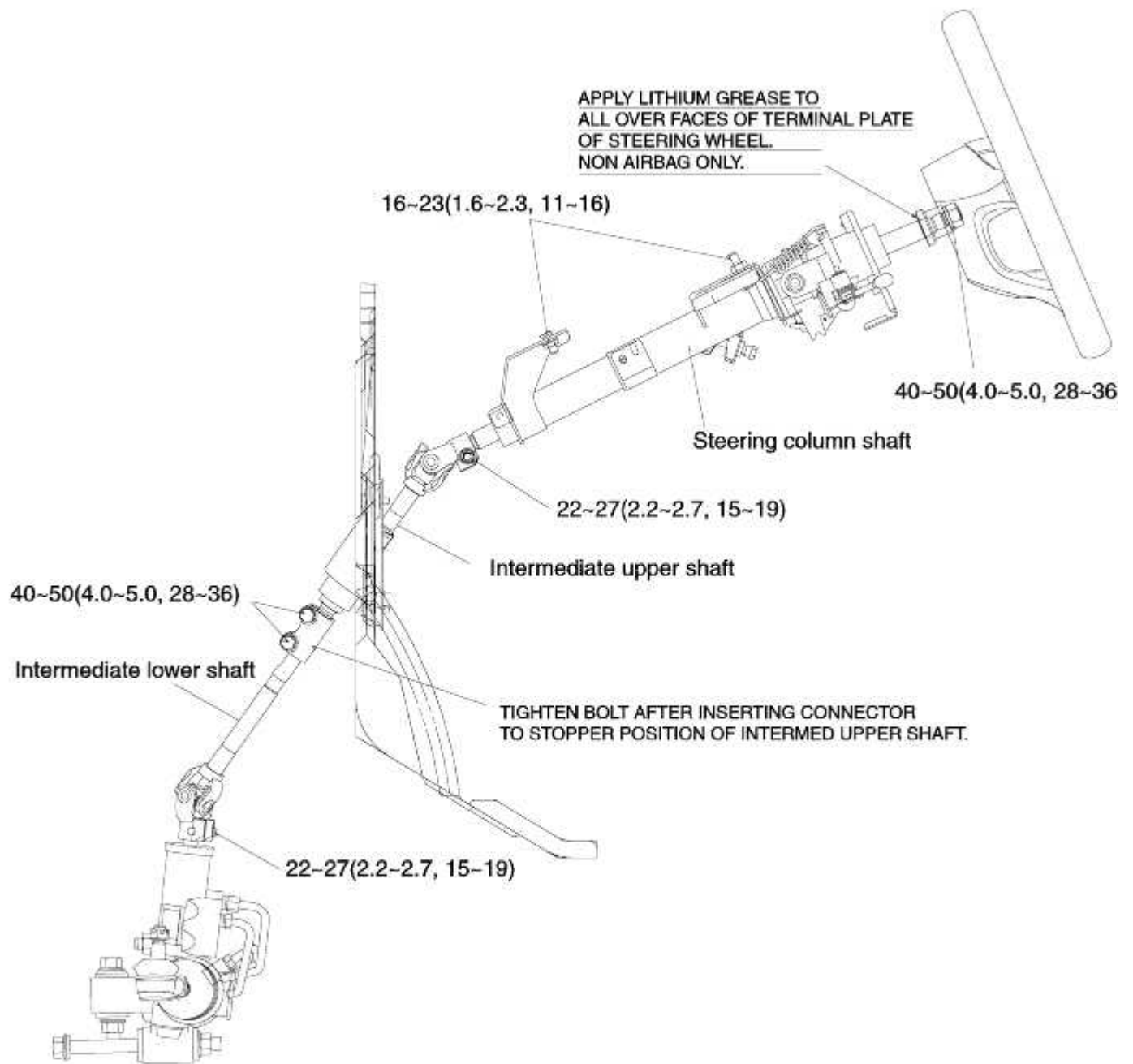
Items	Specifications
Steering wheel diameter (Outer)	386mm
Power steering gear box	Rack and pinion
Steering gear type	∞
Steering gear ratio	81mm x 2
Rack stroke	
Oil pump	
Oil pump type	Vane type
Displacement	9.6 cc/rev

#### SERVICE SPECIFICATIONS

Items		Specifications
Steering wheel free play	mm	30
Steering gear angle		
Inner wheel	2WD (4WD)	$36.94^{\circ} \pm 2^{\circ}$ ( $37.15^{\circ} \pm 2^{\circ}$ )
Outer wheel	2WD (4WD)	$32.02^{\circ} \pm 2^{\circ}$ ( $32.05^{\circ} \pm 2^{\circ}$ )
Stationary steering effort	kg (lbs)	3.3 (7.3)
Drive belt tension	mm (in)	6 - 7 (0.236 - 0.275)
Oil pump pressure	kg/cm <sup>2</sup> (psi)	
Gauge hose valve closed - General		89 - 95 (1,265 - 1,351)
Gauge hose valve closed - EPS		79 - 85 (1,123 - 1,208)
Gauge hose valve opened		4 - 6 (56 - 85)
Power steering oil	liter	PSF - 3 (0.85 - 0.9)

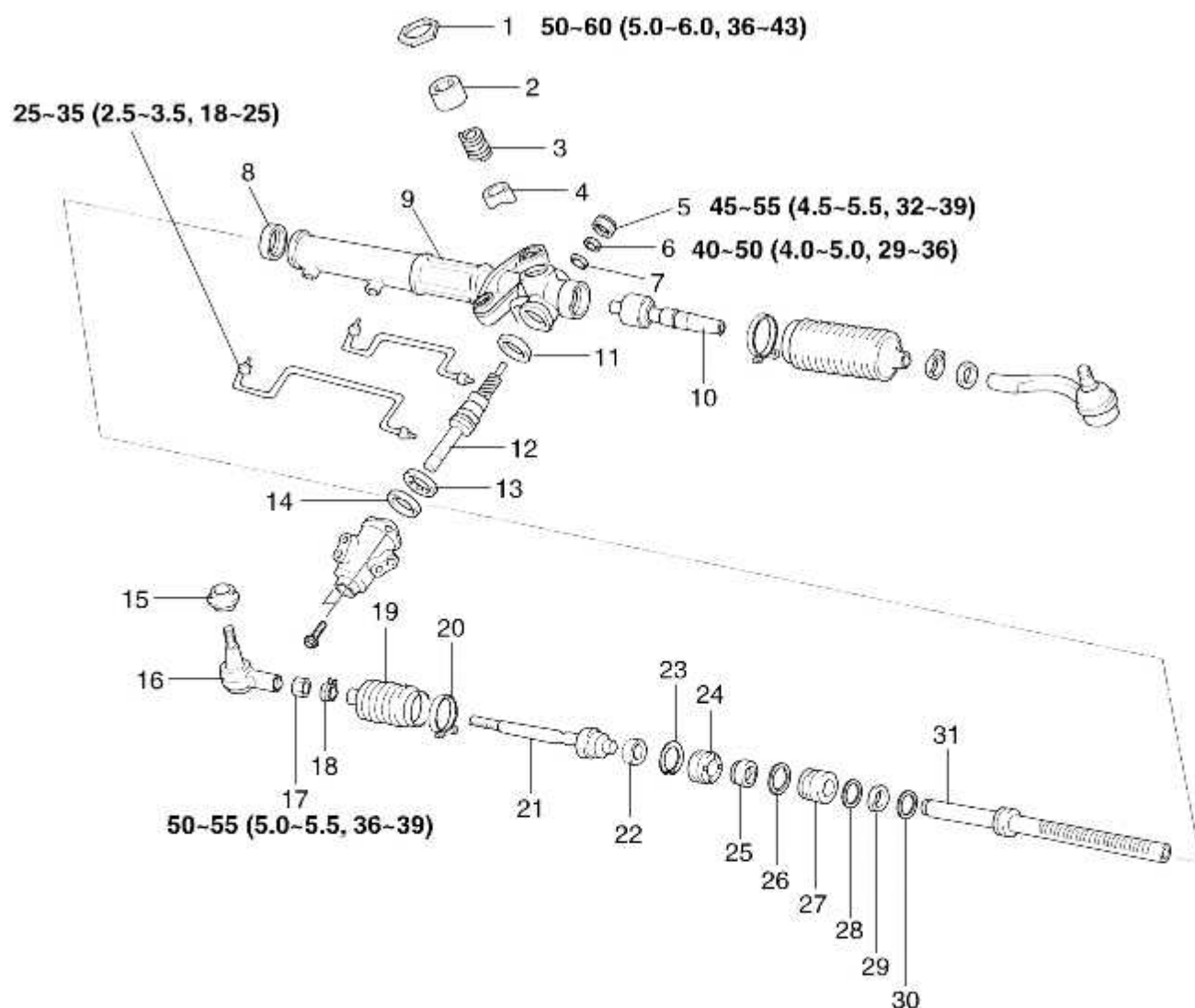
### Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Components and Components Location

#### COMPONENTS



Torque : Nm(kg-m, lb-ft)

## COMPONENTS



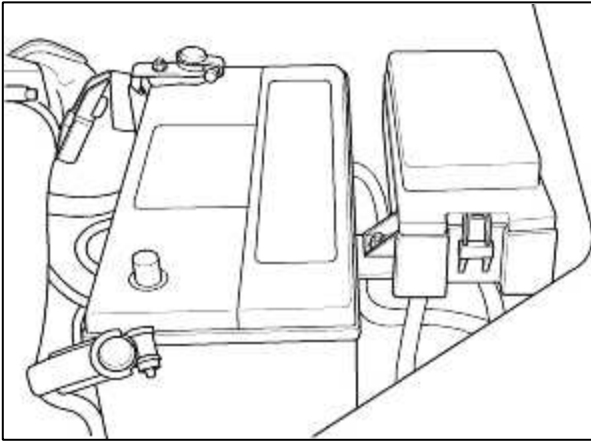
**TORQUE : Nm (kg·m, lb·ft)**

1. Lock nut	12. Pinion and valve assembly	22. Tab washer
2. Yoke plug	13. Ball bearing	23. Circlip
3. Rack support spring	14. Oil seal	24. Rack stopper
4. Rack support	15. Dust covers	25. Oil seal
5. End plug	16. Tie rod ends	26. O-ring
6. Self-locking nut	17. Tie rod end lock nut	27. Rack bushing assembly
7. Ball bearing	18. Bellows clip	28. Oil seal
8. Oil seal	19. Bellows	29. O-ring
9. Rack housing	20. Bellows band	30. Oil seal
10. Tie rod	21. Tie rod	31. Rack
11. Oil seal		

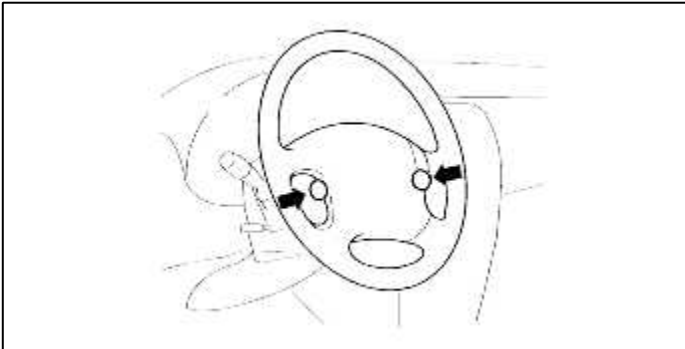
## Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Repair procedures

### REMOVAL

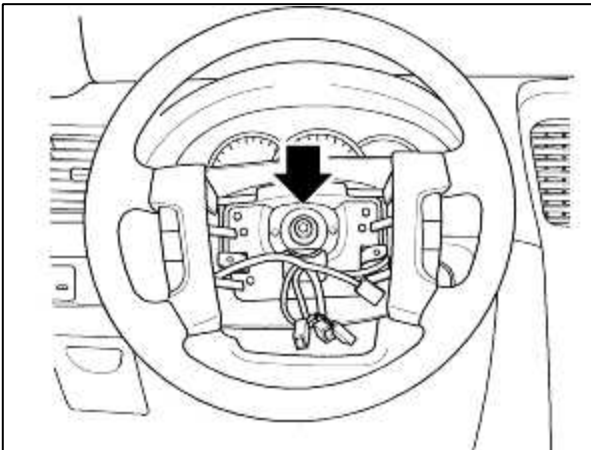
1. Disconnect the negative (-) terminal from the battery.



2. After removing the two hexagon-bolts in the illustration, remove the driver's airbag module.



3. Remove the steering wheel lock nut.

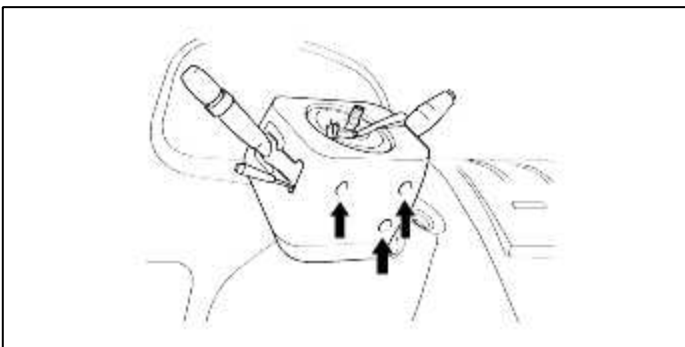


4. After aligning the marks on the steering shaft and wheel, remove the steering wheel.

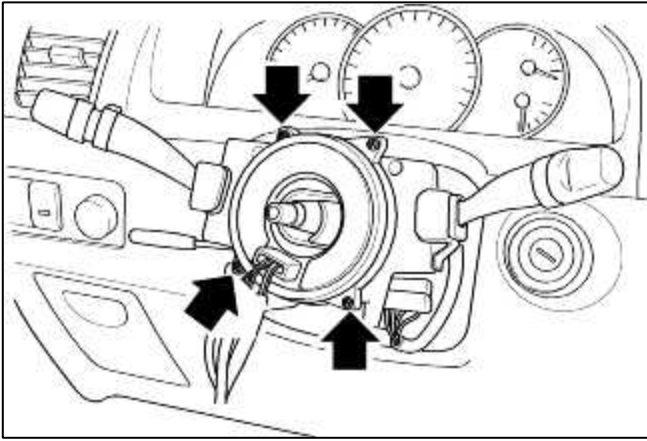
**CAUTION**

Do not hammer on the steering wheel to remove it; it may damage the steering column.

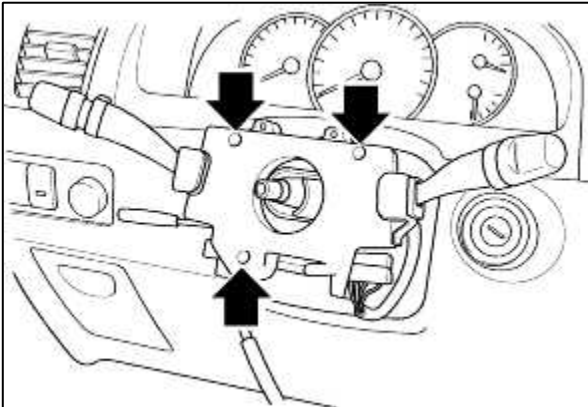
5. After removing the three screws in the illustration, remove the steering column upper and lower shrouds.



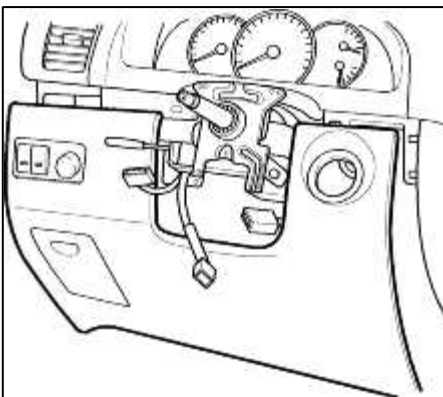
6. After removing the screws in the illustration, remove the clock spring.



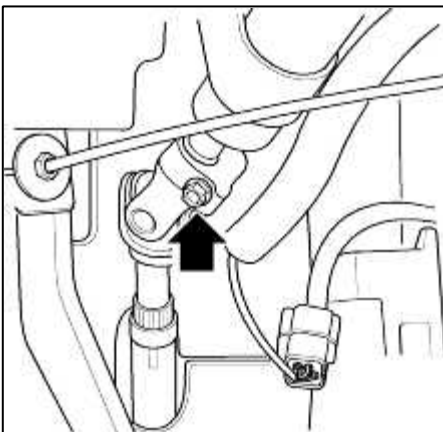
7. Remove the connectors from the multifunction switch and the multifunction switch.



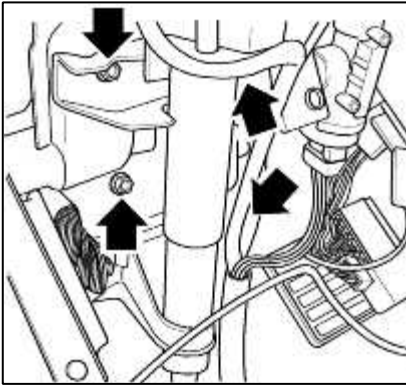
8. Remove the lower crash pad.



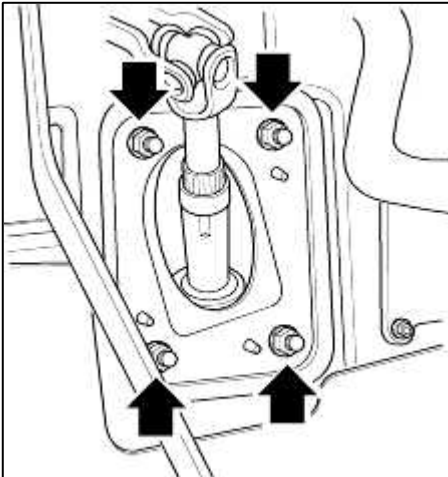
9. Remove the bolt connecting the steering column shaft assembly with the intermediate upper shaft, and then separate them apart.



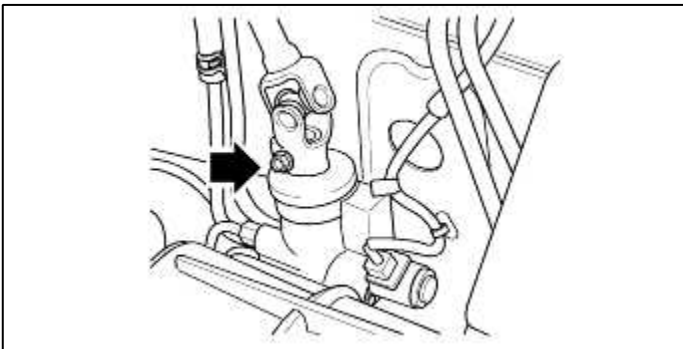
10. After removing the four mounting bolts, remove the steering column shaft assembly.



11. Remove the four mounting bolts in the dust cover assembly.



12. Remove the bolt tightening the intermediate upper shaft and intermediate lower shaft, and then separate them apart.
13. After removing the bolt connecting the steering gear box with the intermediate lower shaft, separate the intermediate lower shaft from the gearbox.



#### CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.

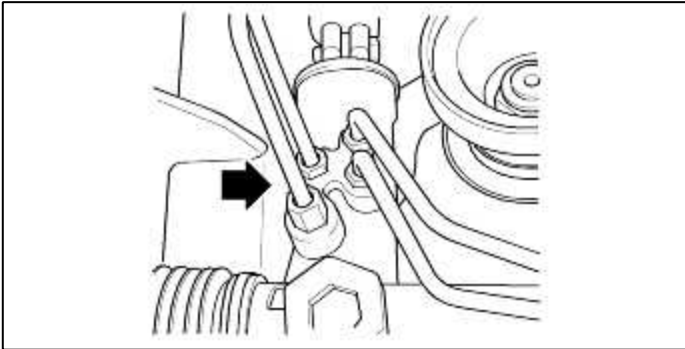
## REMOVAL

1. Drain the power steering fluid.

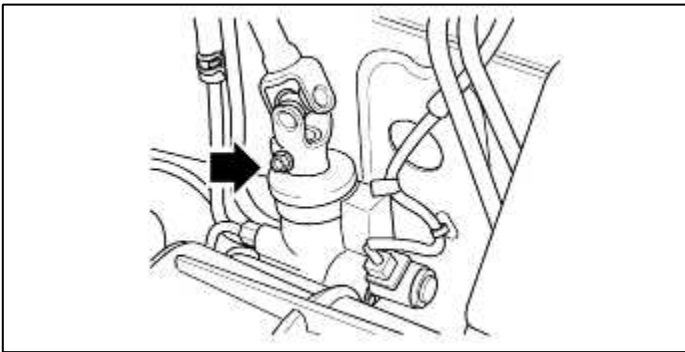
2. Disconnect the pressure tube and return tube.

Tightening torque:

32 - 48 N·m (3.2 - 4.8 kg-m, 23 - 34 lb-ft)



3. Remove the joint assembly connecting bolt.



4. Using the special tool (0K670-321-019), disconnect the tie rod end from the knuckle arm.

Tightening torque:

70 - 80 N·m (7.0 - 8.0 kg-m, 50 - 57 lb-ft)





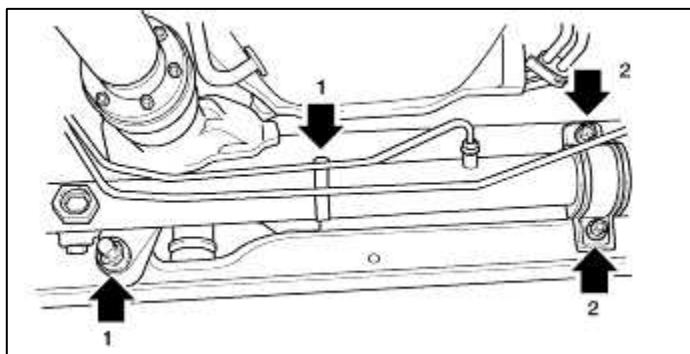
5. Remove the steering gear box mounting bolts and remove the steering gear box assembly together with mounting rubber.

**CAUTION**

When removing the gear box, pull it out carefully and slowly to avoid damaging the boot.

Tightening torque:

- 1) 122 - 158 N·m (12.2 - 15.8 kg-m, 88 - 114 lb-ft)
- 2) 85 - 110 N·m (8.5 - 11.0 kg-m, 62 - 80 lb-ft)



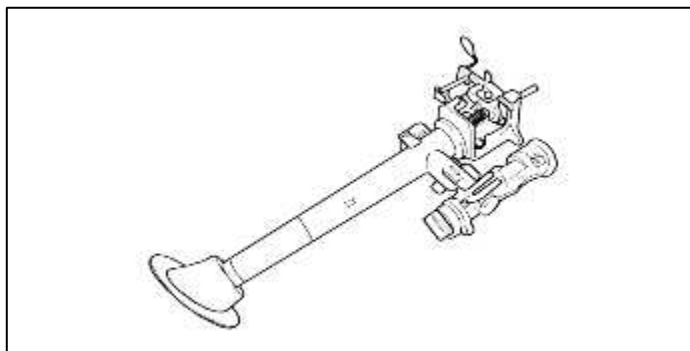
## INSPECTION

1. Check the steering column shaft for damage and deformation.
2. Check the connections for play, damage and smooth operation.
3. Check the ball joint bearing for wear and damage.

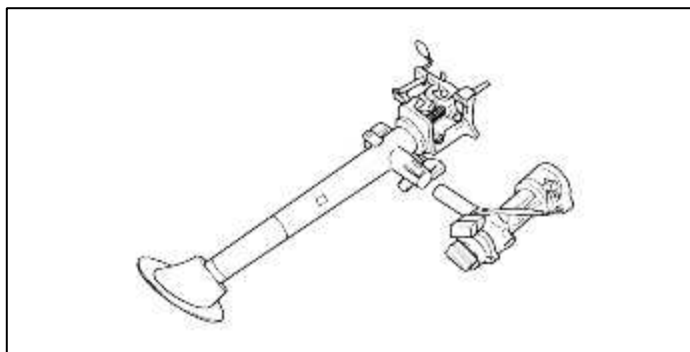
## REASSEMBLY

### DISASSEMBLY AND REASSEMBLY

1. If it is necessary to remove the key lock assembly, use a pinch to make a groove on the head of the special bolt, and then use a screwdriver to remove the key lock assembly mounting bracket.



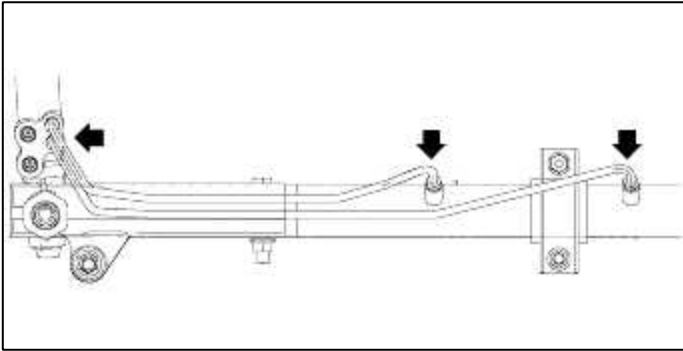
2. Disassemble the key lock assembly from the steering column shaft.



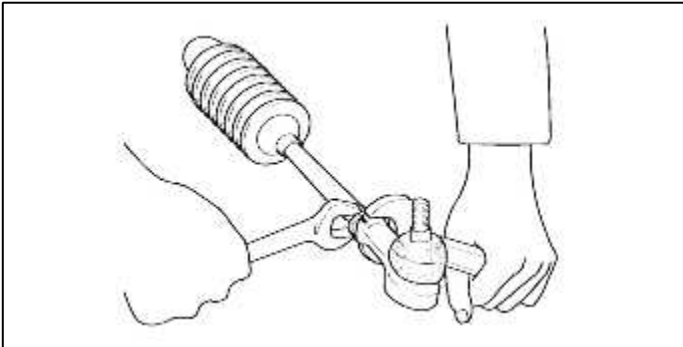
3. Reassembly is the reverse of disassembly.

## DISASSEMBLY

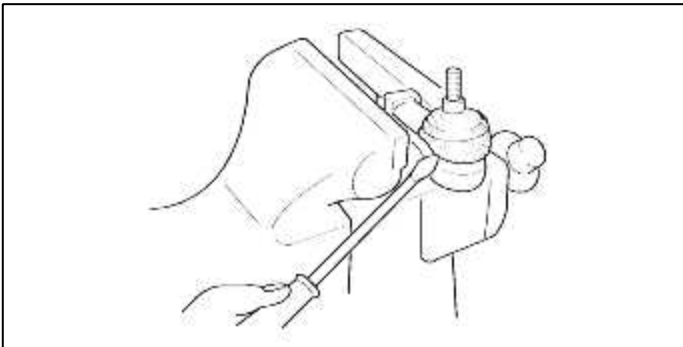
1. Remove the feed tube.



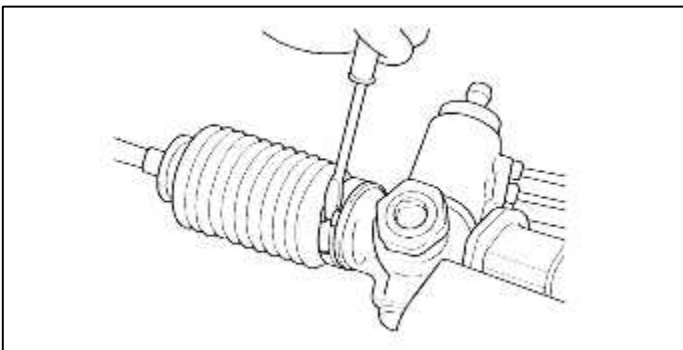
2. Remove the tie rod end from the tie rod.



3. Remove the dust cover from the ball joint.



4. Remove the bellows band.

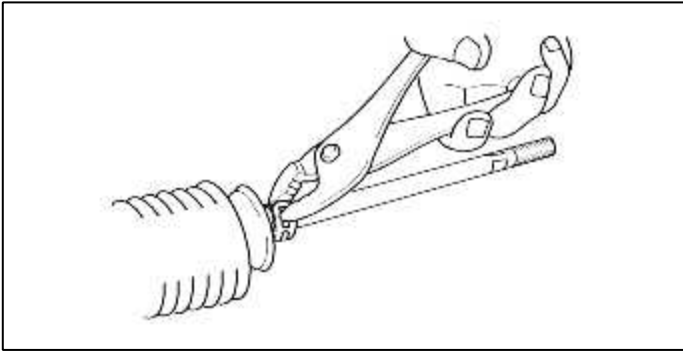


5. Remove the bellows clip. Pull the bellows out toward the tie rod.

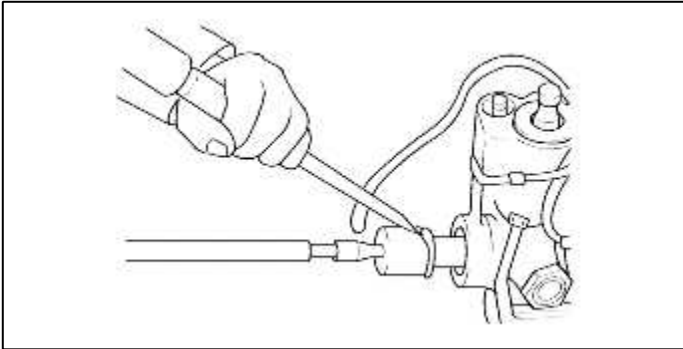
### NOTE

Check for rust on the rack when the bellows are replaced.

6. Remove the feed tube from the rack housing.



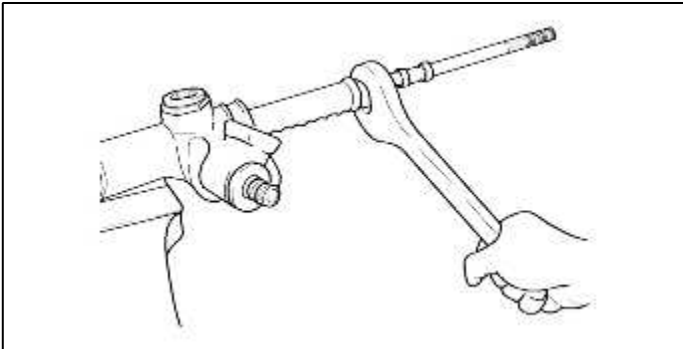
7. While moving the rack slowly, drain the fluid from the rack housing.  
 8. Unstake the tab washer which fixes the tie rod and rack with a chisel.



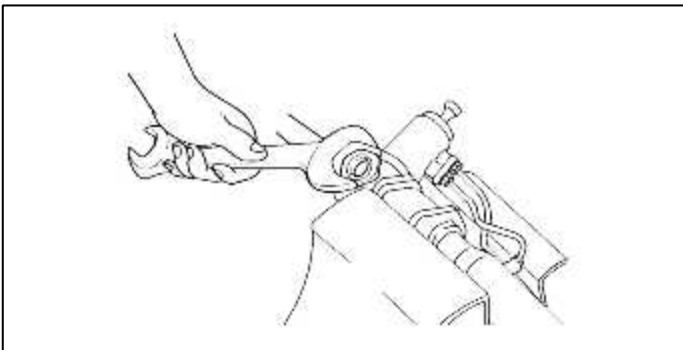
9. Remove the tie rod from the rack.

**CAUTION**

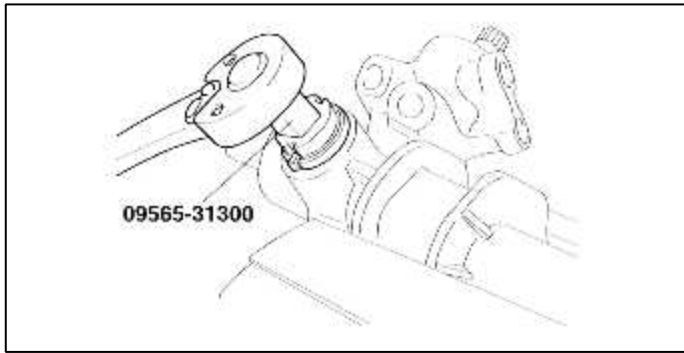
Remove the tie rod from the rack, taking care not to twist the rack.



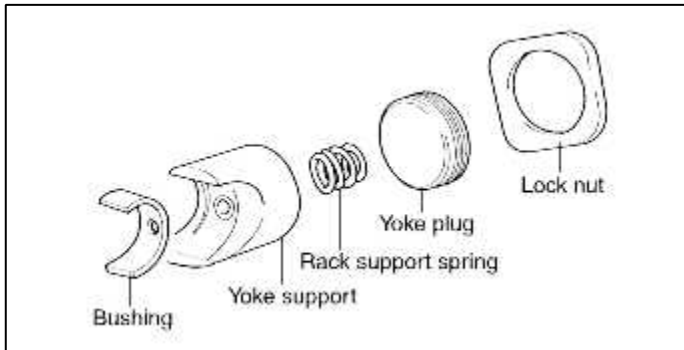
10. Remove the yoke plug lock nut.



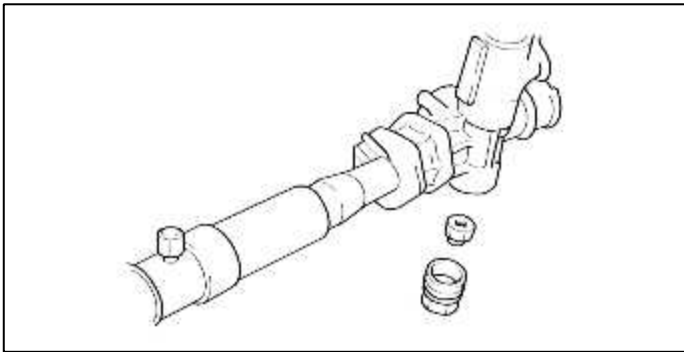
11. Using the special tool (09565-31300), remove the yoke plug.



12. Remove the rack support spring, yoke support and bushing from the gear box.



13. Remove the end plug and self-locking nut.

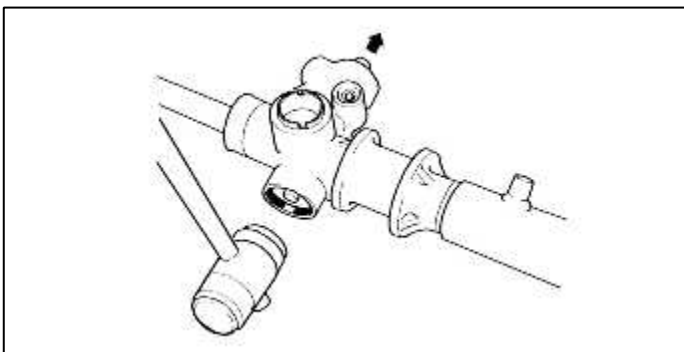


14. Detach the dust seal.

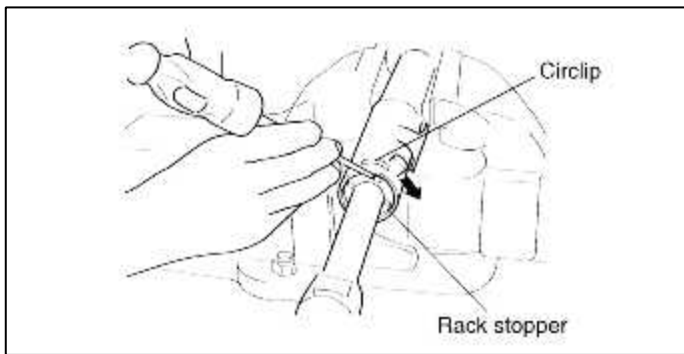
15. Remove the snap ring with snap ring pliers.

16. Remove bolts mounting the valve assembly to the rack housing.

17. Remove the pinion and valve assembly together with the oil seal (upper) using a soft hammer.



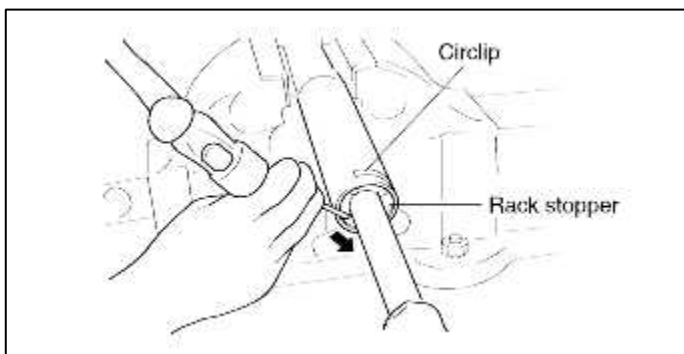
18. Turn the rack stopper clockwise until the end of the circlip comes out of the slot in the gear housing.



19. When the end of the circlip comes out from the notched hole of the housing rack cylinder, turn the rack stopper counter clockwise and remove the circlip.

**CAUTION**

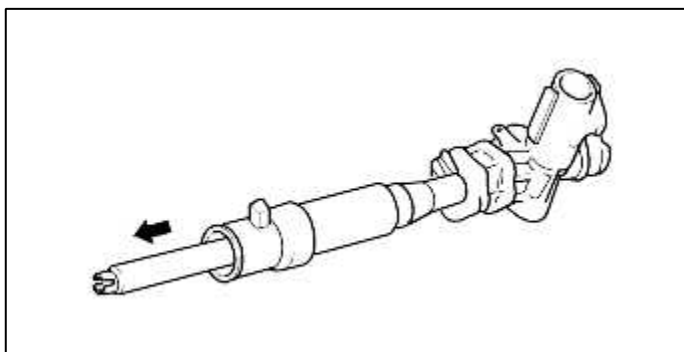
Do not damage the rack when disassembling.



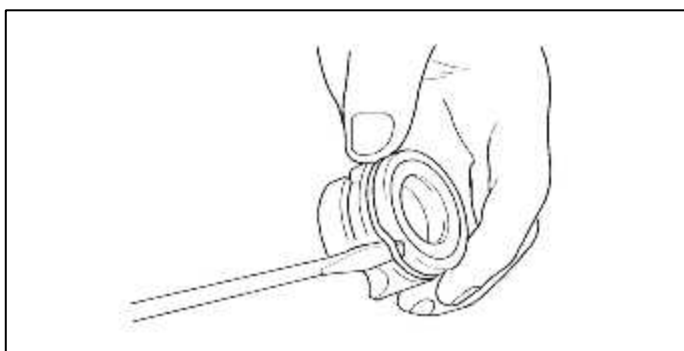
20. Remove the rack stopper, rack bushing and rack from the rack housing by moving it toward the piston side.

**CAUTION**

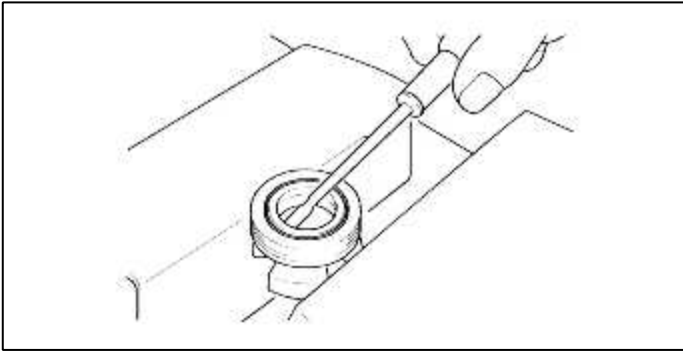
When the rack has been removed, be sure to replace the housing side oil seal with a new one.



21. Remove the O-ring from the rack bushing.



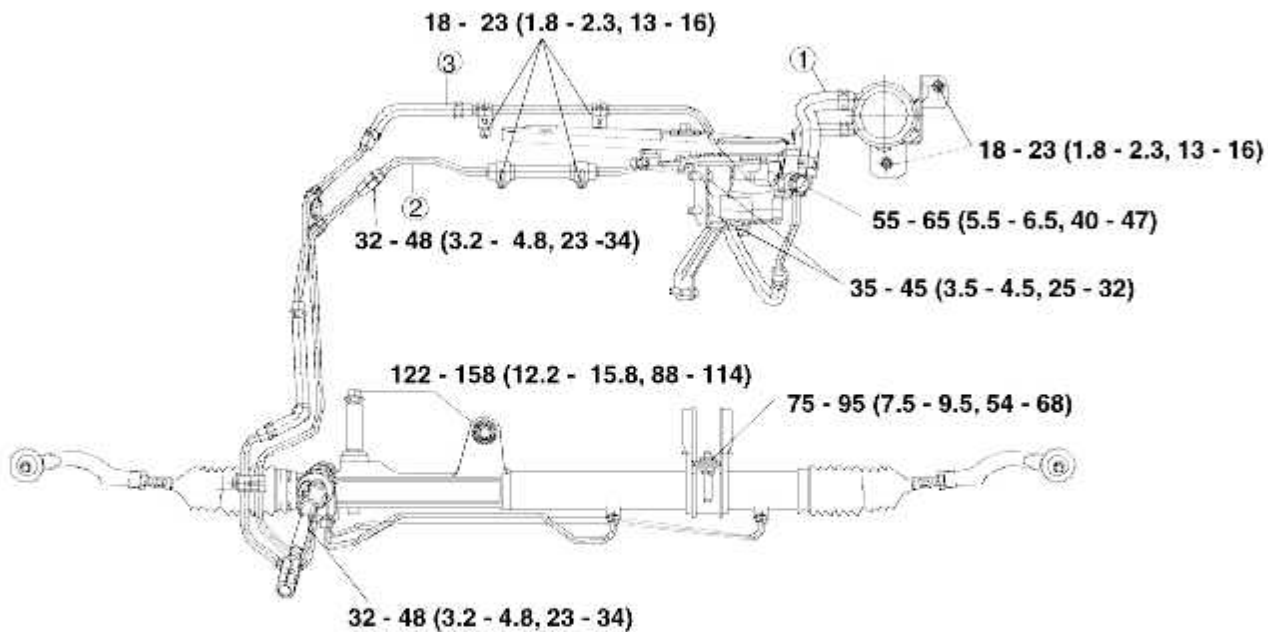
22. Remove the oil seal from the rack bushing.



## Steering System > Hydraulic Power Steering System > Power Steering Hoses > Components and Components Location

### COMPONENT

<3.5G>



Torque : N·m (kg-m, lb-ft)

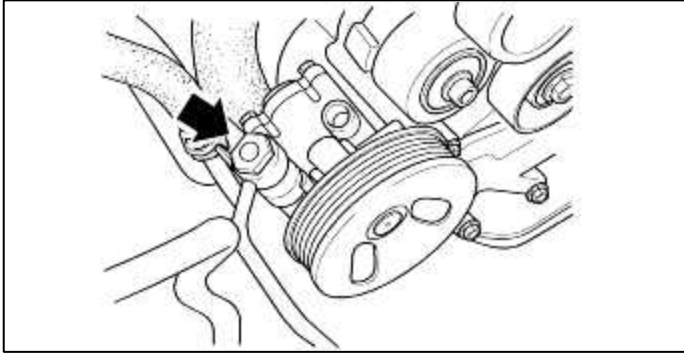
1. Suction hose
2. Pressure hose & tube
3. Return hose & tube

## Steering System > Hydraulic Power Steering System > Power Steering Hoses > Repair procedures

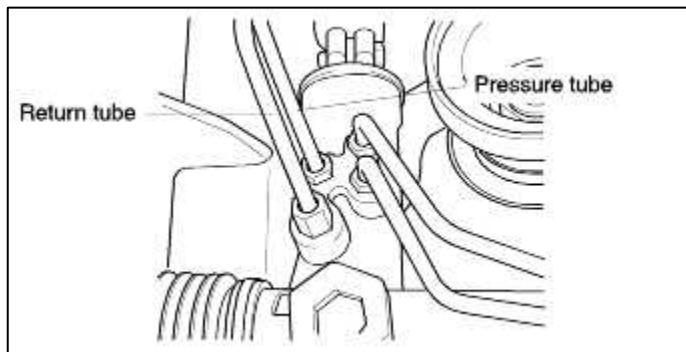
### REMOVAL

## 1. Removal of pressure hose and tube.

- (1) Disconnect the pressure hose from the steering oil pump.

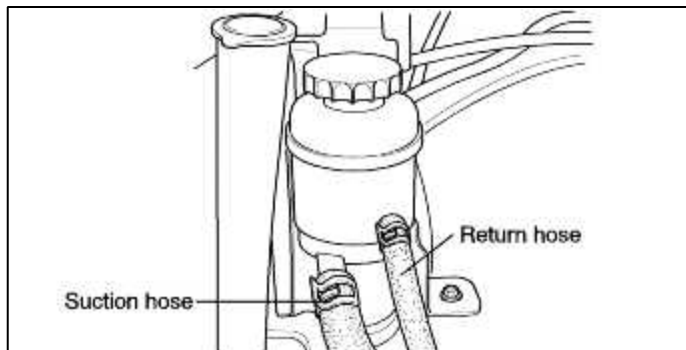


- (2) Loosen the bolt of pressure hose mounting clamp.
- (3) Remove the pressure/return tube clip mounting bolt.
- (4) Disconnect the pressure tube from the steering gear box, and then disconnect the pressure hose and the tube.



## 2. Removal of return hose and tube.

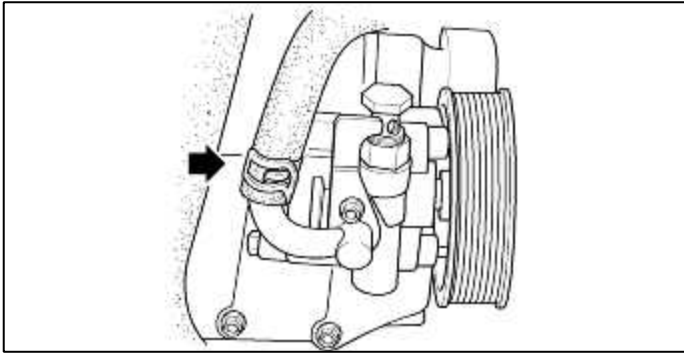
- (1) Disconnect the return hose from the oil reservoir.



- (2) Loosen the return tube clip mounting bolt.
- (3) Remove the return/pressure tube clip mounting bolt.
- (4) Disconnect the return tube from the steering gear box, and then disconnect the return hose and the tube.

### 3. Removal of suction hose.

- (1) Disconnect the suction hose from the steering oil reservoir.
- (2) Disconnect the suction hose.



## INSTALLATION

### CAUTION

- Install the hose lest they should be twisted and come in contact with any other parts.
- After installation, bleed the air.

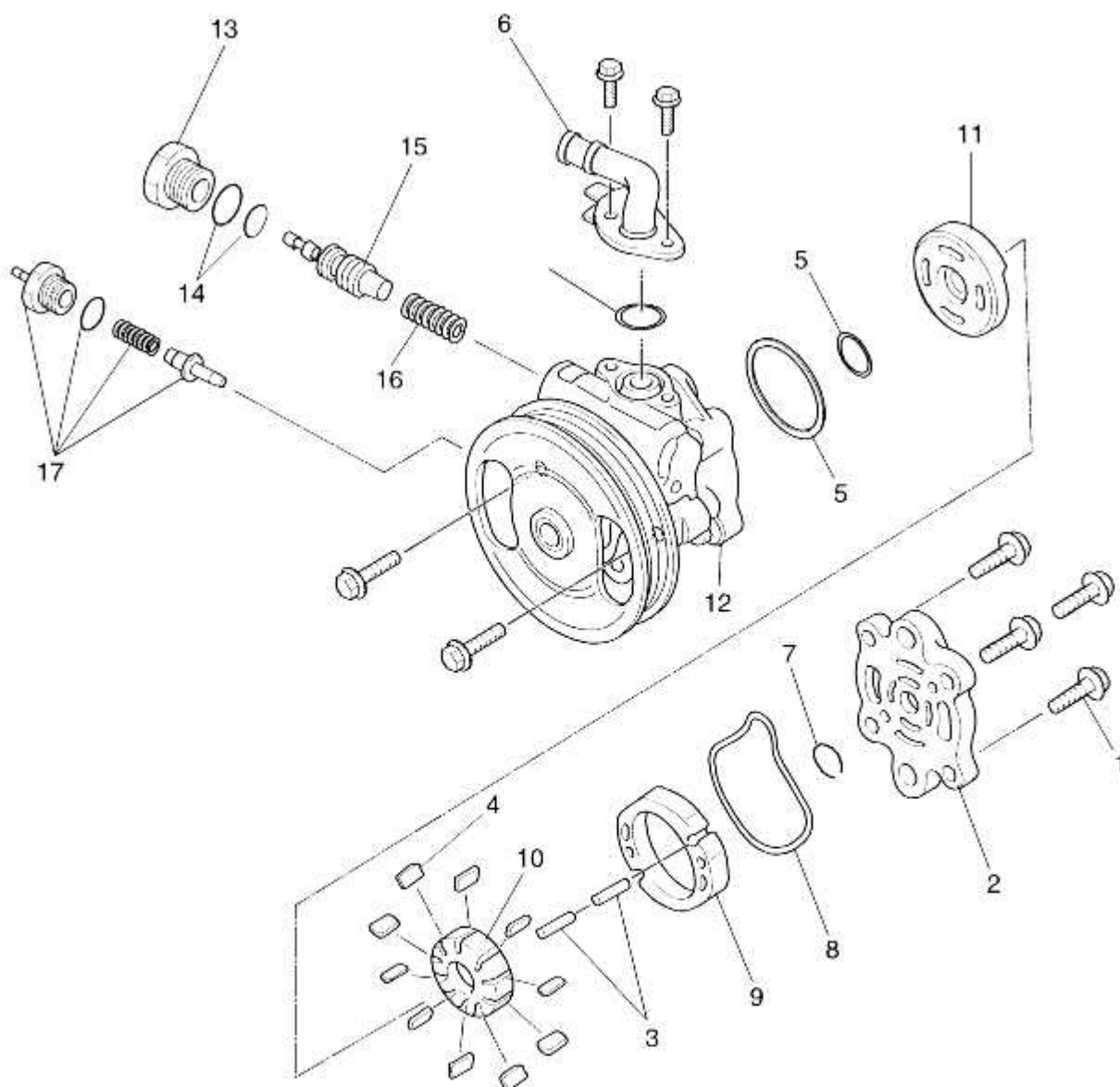
## INSPECTION

1. Inspect the hose for cracks by twisting it by hand.
2. Check for interference between hose and the other parts.

**Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Components and Components Location**

## COMPONENTS



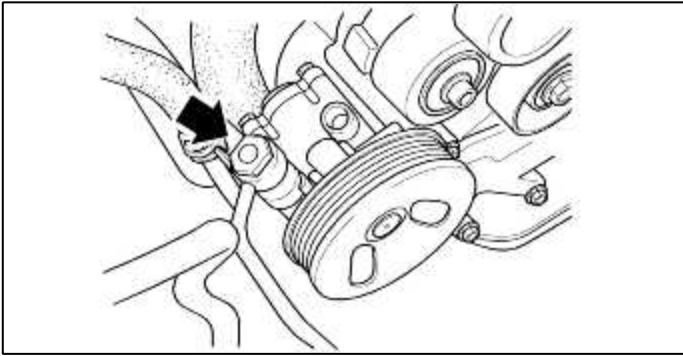


1. Bolt	7. Snap ring	13. Connector
2. Rear cover	8. O-ring	14. O-ring
3. Pin	9. Cam ring	15. Control valve
4. Vane	10. Rotor	16. Spring
5. O-ring	11. Front side plate	17. Pressure switch assembly (2.4G, 3.5G)
6. Suction pipe	12. Front housing	

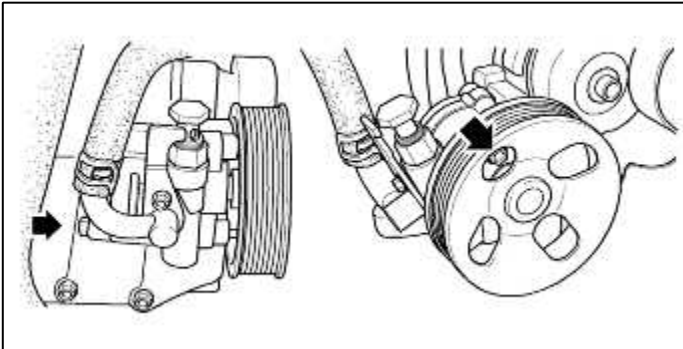
## Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Repair procedures

### REMOVAL

1. Disconnect the pressure hose from the oil pump, disconnect the suction hose from the suction pipe, and drain the oil.



2. Loosen the power steering tension adjusting bolt or flange nut.
3. Separate the belt from the power steering oil pump pulley.
4. Loosen the power steering oil pump mounting bolt, and then remove the power steering oil pump assembly.



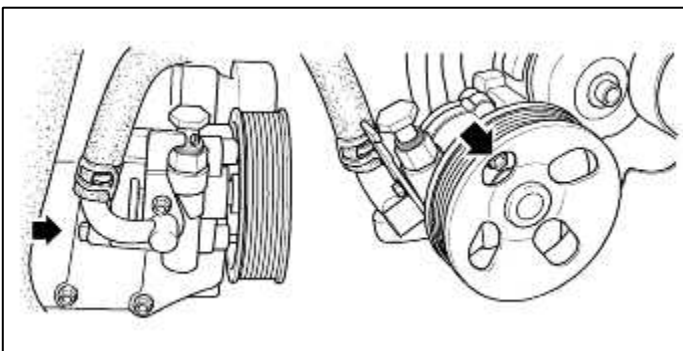
5. Remove the power steering oil pump mounting bracket.

## INSTALLATION

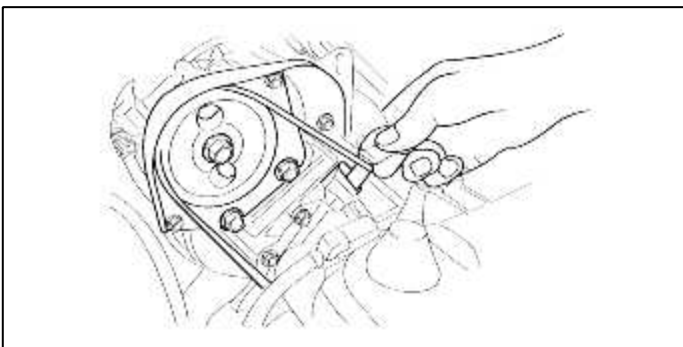
1. After installing the oil pump to the oil pump bracket.

Tightening torque:

18 - 23 N·m (1.8 - 2.3 kg-m, 13 - 16 lb-ft)



2. Install the belt and tighten the bolt adjusting tension to the specified torque.



3. Install the suction hose.

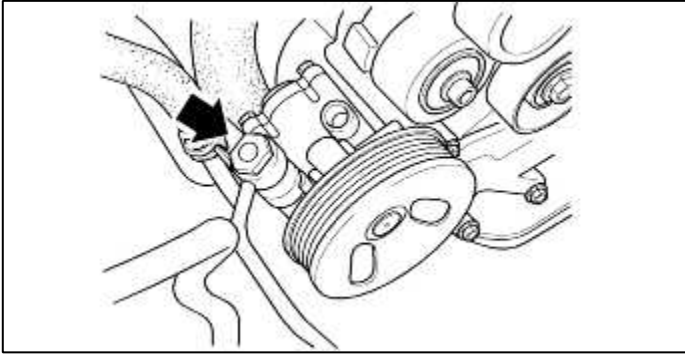
**CAUTION**

Install the pressure hose to the oil pump.

4. Install the pressure hose to the oil pump.

**NOTE**

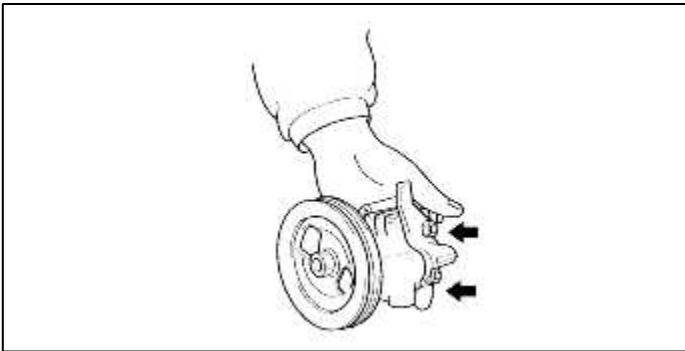
Install the pressure hose being careful so that it does not twist and come in contact with other components.



5. Add power steering fluid (PSF-III).
6. Air bleed the system.
7. Check the oil pump pressure.

**DISASSEMBLY**

1. Remove the two bolts (12 mm) from oil pump body, and then remove the suction pipe and O-ring.

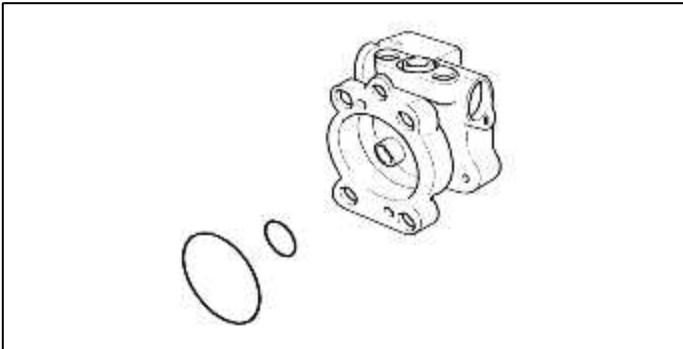


2. Remove the four bolts (14 mm), and then remove the rear cover assembly.
3. Remove the snap ring.
4. Remove the rotor and the vane.
5. Remove the oil pump side plate.

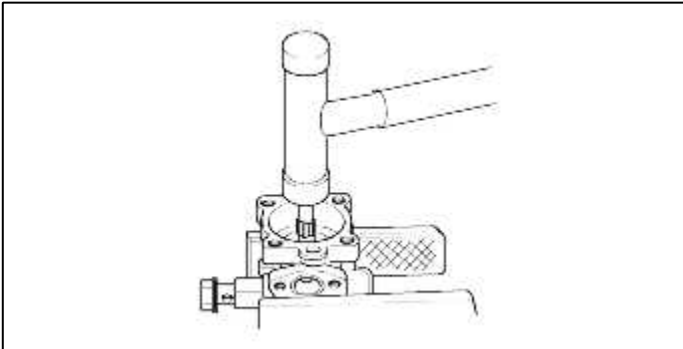
6. Remove the inner and outer O-ring.

**NOTE**

When assembling, use an O-ring.



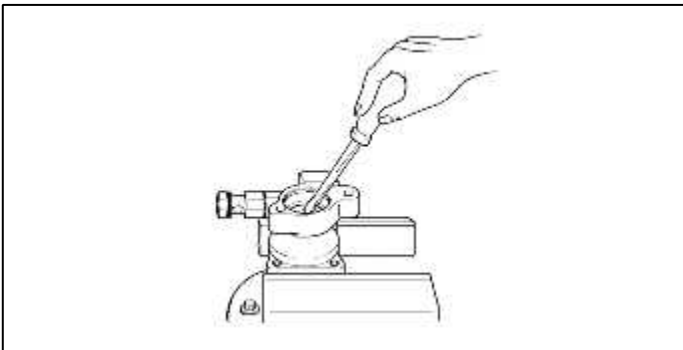
7. Tap the rotor side of the shaft slightly with a plastic hammer to remove the shaft.



8. Remove the oil seal from the oil pump body.

**NOTE**

When assembling, use a new oil seal.

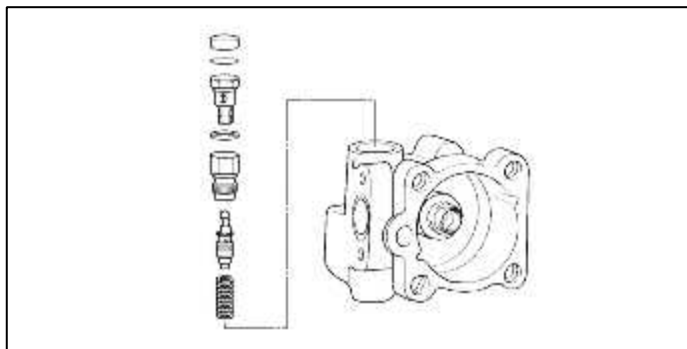


9. Remove the connector from the oil pump body, and take out the flow control valve and the flow control spring.

10. Remove the O-ring from the connector.

**CAUTION**

Do not disassemble the flow control valve.

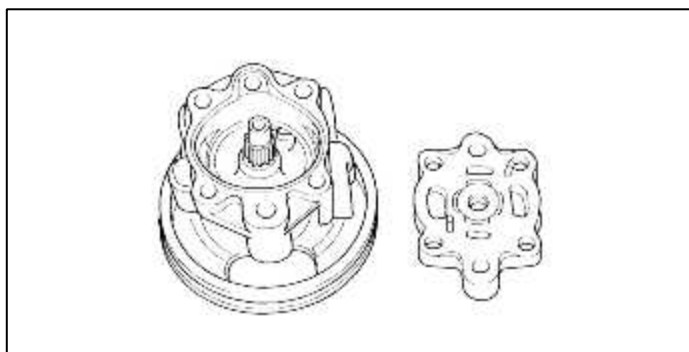


## INSPECTION

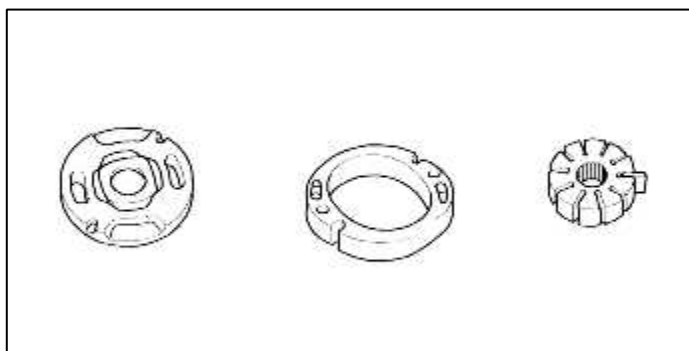
**NOTE**

Replace the pump assembly if necessary.

1. Check the front and rear pump bodies for cracking or other damage and for abnormal wear of the moving surface of the rotor.

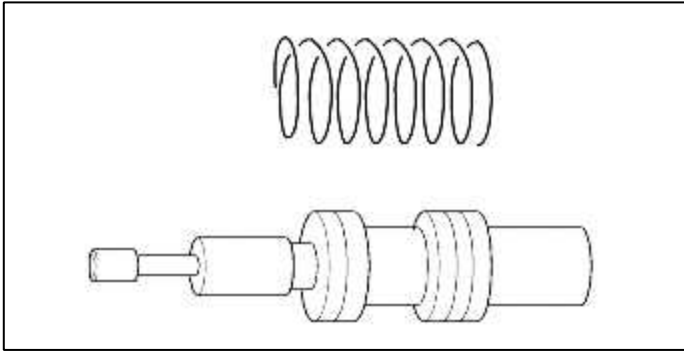


2. Check the moving surface of the cam ring's vanes for abnormal wear.
3. Check the moving surface of the side plate and the pump bodies for abnormal wear.
4. Check the moving surface of the vane cam ring for abnormal wear.
5. Check the clearance of the rotor and vanes.



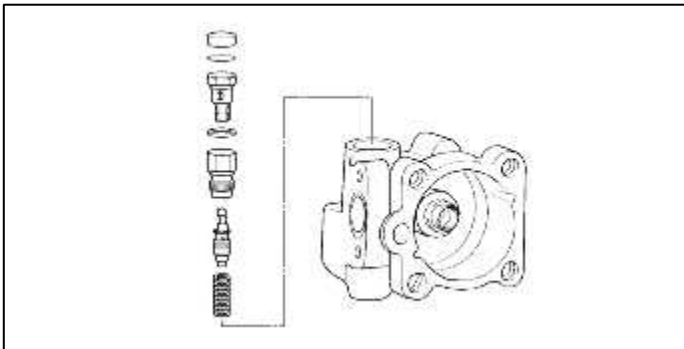
6. Check the control valve for cracking and other damage, for clogging, and for abnormal wear of the moving part.

7. Check the spring for damage.

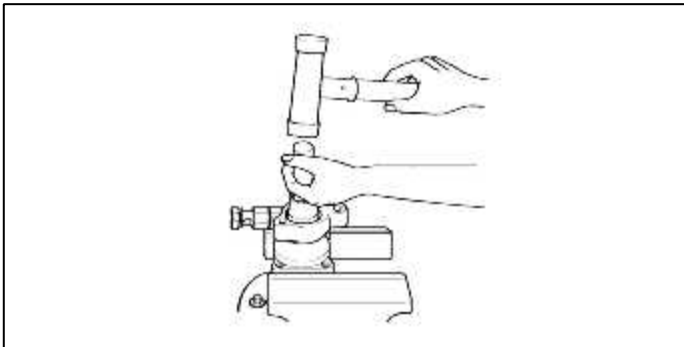


## REASSEMBLY

1. Install the flow control spring the flow control valve and the connector in to the pump body.



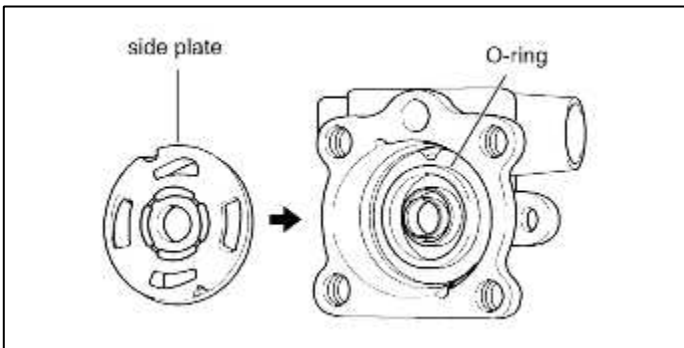
2. Install the oil seal in the pump body by using the special tool.



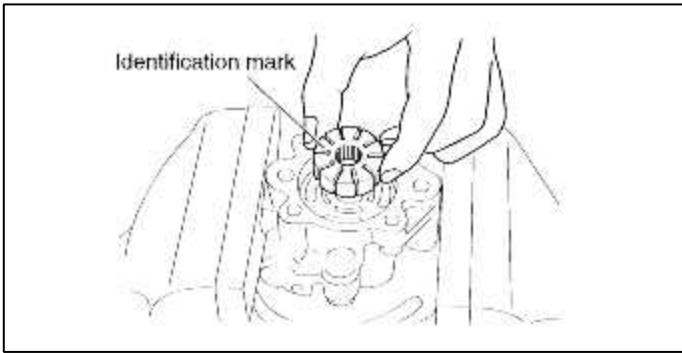
3. After inserting the shaft assembly into the pump body.

4. Install the outer and inner O-ring in the pump body.

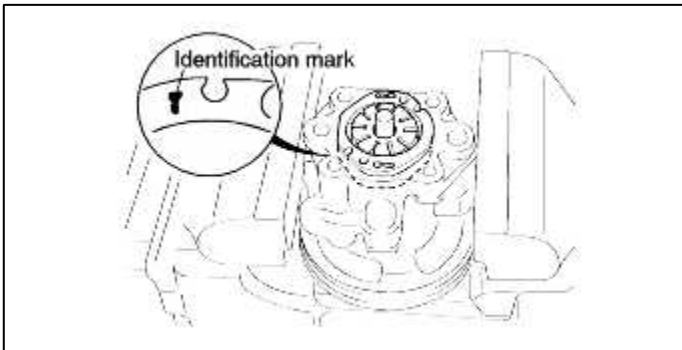
5. Insert the oil pump side plate in the pump body.



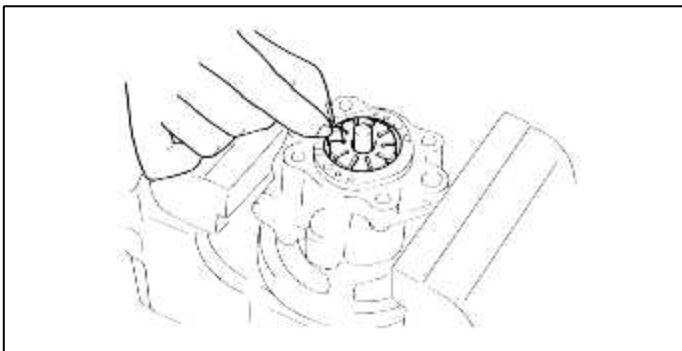
6. Install the rotor to the shaft with the rotor's identification mark facing upward.



7. Install the cam ring so that its identification mark is facing downward.

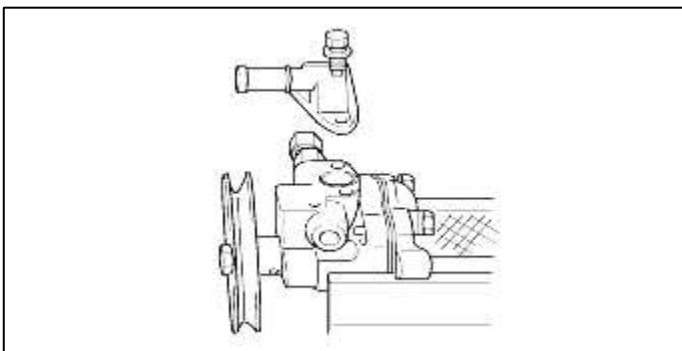


8. Install the vanes (10 pieces) to the rotor, with the R part of the vanes facing outward.



9. Install the O-ring and oil pump cover assembly.

10. Install the suction pipe and O-ring.



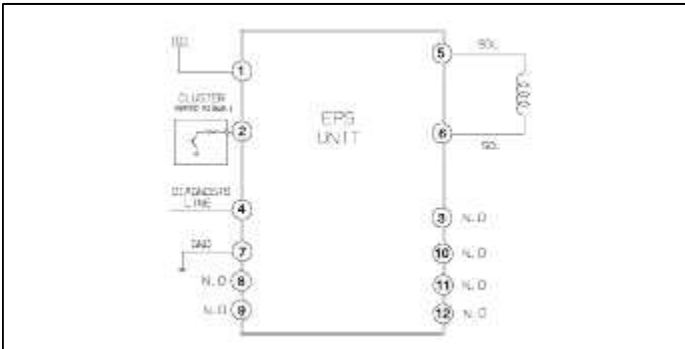
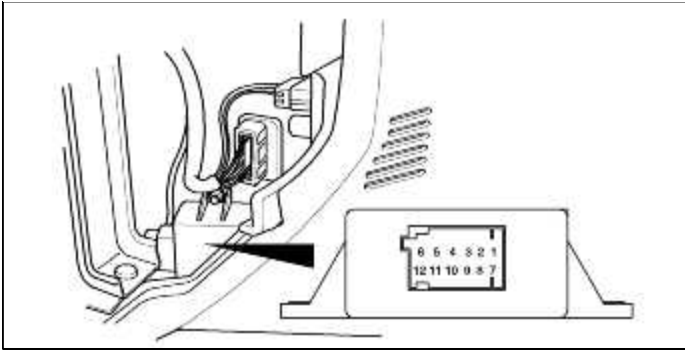
## Steering System > Electronic Power Steering System > Description and Operation

### GENERAL

EPS performs the conventional power steering function in case a fail has occurred in the system.

EPS electronically controls the current to the solenoid of by-pass valve by input sensor's signal to control the hydraulic amount in cylinder chamber thereby varying the steering effort versus the hydraulic pressure according to vehicle speed.

### ELECTRONIC POWER STEERING UNIT



## EPS SOLENOID

### SOLENOID VALVE

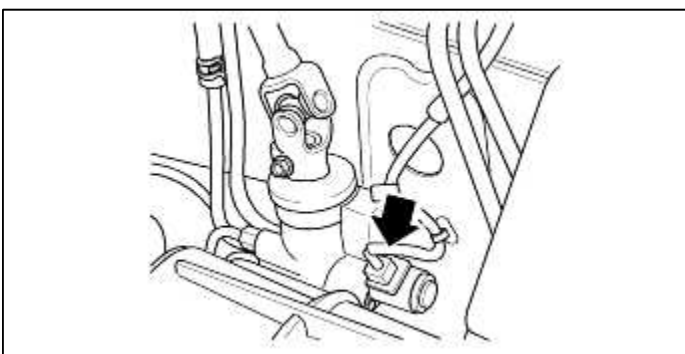
The input current is varying from 0A to 1A according to the vehicle speed and is controlled by EPS unit.

When the ignition switch is turned on, current is sent to the solenoid valve to push up the plunger and accordingly the piston contacting the plunger is pushed up while overcoming the spring force. As the vehicle speed increasing the current flow to the solenoid decreased pulling down the piston bottom by the releasing spring force.

When the piston is pushed up, it closes the oil passing hole, therefore the power steering oil pressure is delivered into the cylinder without any interruption. But when the hole is opened as the piston is pulling down, some of the oil coming from the rotary valve is drained into reservoir via the hole inside the rotary valve.

#### NOTE

When it is necessary to remove the EPS gear box, be sure to disconnect the connector to avoid damage.





**SORENTO(BL) > 2007 > G 3.3 DOHC > Suspension System****Suspension System > General Information > Specifications****SPECIFICATIONS****FRONT SUSPENSION**

Item			Specification
Suspension type			Double wishbone
Shock absorber	Type		Gas pressurized
	Stroke		112mm (4.41in.)
	Damping force (Piston speed: 0.3m/s)	Compression	79±15kg (849±74N)
		Extension	157±22kg (1540±216N)
	I.D. color		Red
Coil spring	2WD	Free height	353.3mm (13.91in.)
		I.D. color	Blue
	4WD	Free height	352.4mm (13.87in.)
		I.D. color	Yellow

**REAR SUSPENSION**

Item			Specification
Suspension type			5 link coil spring
Shock absorber	Type		Gas pressurized
	Stroke		186mm (7.32in.)
	Damping force (Piston speed: 0.3m/s)	Compression	83±15kg (814±147N)
		Extension	140±20kg (1373±196N)
	I.D. color		Red
Coil spring	Free height		367.8mm (14.48in.)
	I.D. color		Yellow

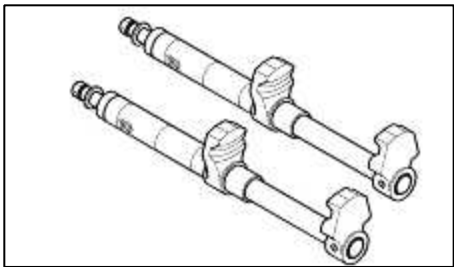
**WHEEL AND TIRE**

Item		Specification
Tire		245/70 R16
		245/65 R17
Wheel		7.0JJ × 16
		7.0JJ × 17
Tire pressure	Front	2.1kg/cm <sup>2</sup> (30psi)
	Rear	2.1kg/cm <sup>2</sup> (30psi)

**WHEEL ALIGNMENT**

Item		Specification	
		Front	Rear
Toe-in	Total	0°±0.2°	
	Individual	0°±0.1°	
Camber angle		0.00±0.5°	
Caster angle	To ground	3.89°±0.5°	
	To body	4.43°±0.5°	
King pin angle		12.13°	

**Suspension System > General Information > Special Service Tools****SPECIAL SERVICE TOOL**

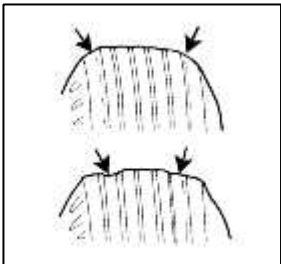
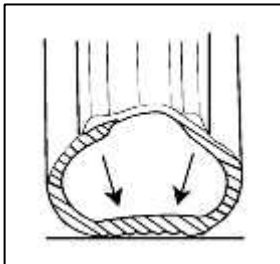
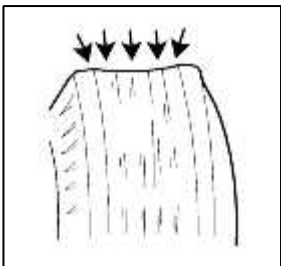
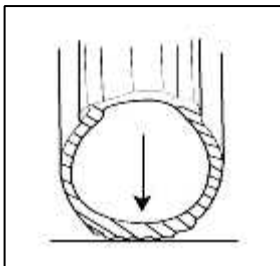
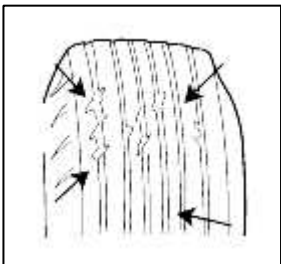
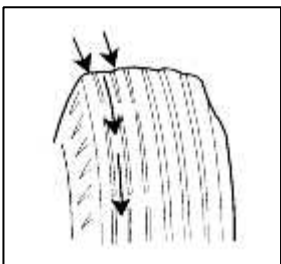
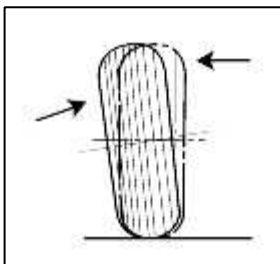
Tool (Number and name)	Illustration	Use
0K2A1 341 001A Coil spring compressor		For removal of front shock absorber spring

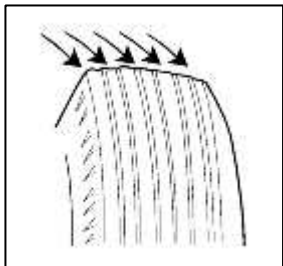
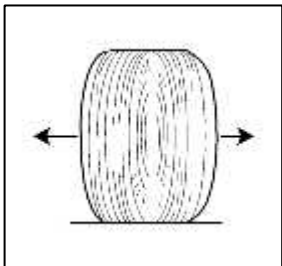
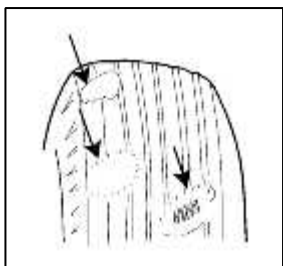
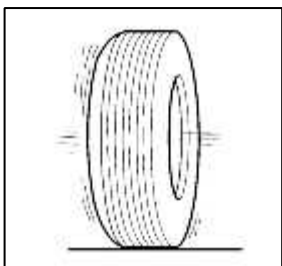
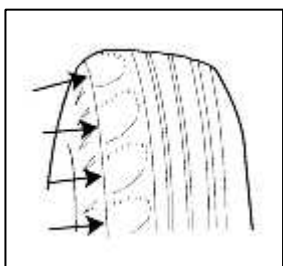
**Suspension System > General Information > Troubleshooting****TROUBLESHOOTING**

Symptoms	Possible causes	Remedy
Excessive vehicle rolling	Broken or deteriorated stabilizer	Replace
	Damaged shock absorber	Replace
Abnormal noise	Loose mounting parts	Retighten
	Broken or worn wheel bearing	Replace
	Shock absorber malfunction	Replace
	Damaged tire	Replace
Poor riding	Excessive tire inflation pressure	Adjust the tire inflation the pressure
	Shock absorber malfunction	Replace
	Loose wheel nut	Tighten to the specified torque
	Distorted or broken coil spring	Replace
	Damaged tire	Replace
	Worn bushing	Replace

Vehicle leans to one side	Deformed arm assembly	Replace
	Worn bushing	Replace
	Distorted or broken coil spring	Replace
Hard steering	Improper front wheel alignment	Repair
	Excessive turning resistance of lower arm ball joint	Replace
	Lack of tire inflation pressure	Adjust
	Power steering malfunction	Repair or Replace
Wandering	Improper front wheel alignment	Repair
	Worn or loose lower arm bushing	Retighten or Replace
Bottoming	Broken or worn coil spring	Replace

## DIAGNOSIS (TIRES/WHEELS)

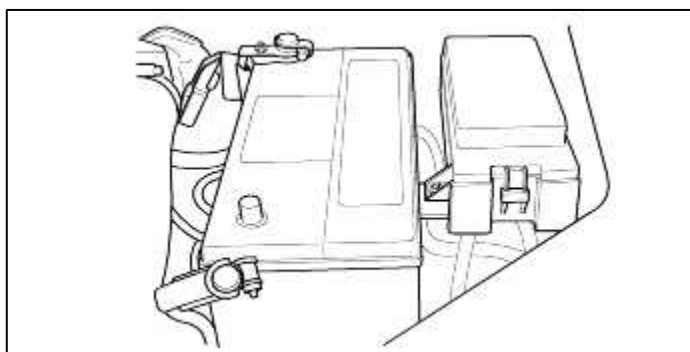
Problem		Possible Cause		Action
Rapid wear at shoulders		Under-inflation or lack of rotation		Adjust the tire pressure
Rapid wear at center		Over-inflation or lack of rotation		
Cracked treads		Under-inflation		
Wear on one side		Excessive camber		Inspect the camber

Feathered edge		Incorrect toe		Adjust the toe-in
Bald spots		Unbalanced wheel		Adjust the imbalanced wheels
Scalloped wear		Lack of rotation of tires or worn or out-of-alignment suspension		Rotate the tires inspect the front suspension alignment

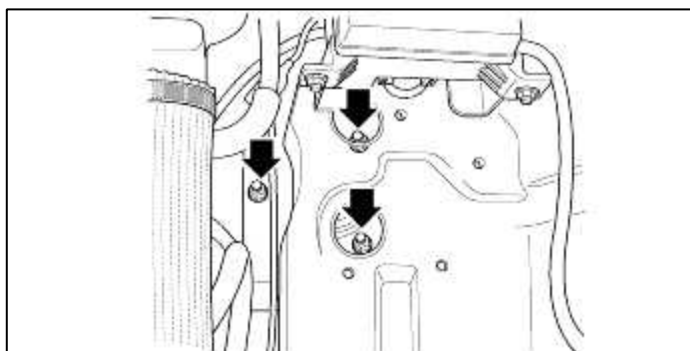
### Suspension System > Front Suspension System > Front Strut Assembly > Repair procedures

#### REMOVAL

1. Loosen battery cable and mounting bolt and then remove battery.

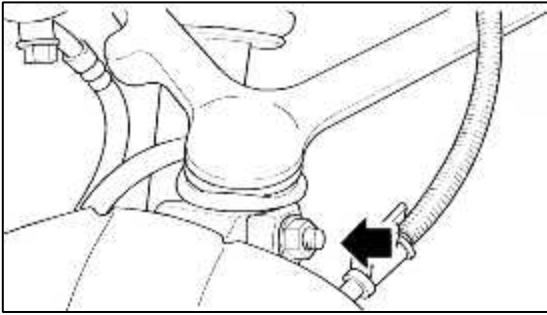


2. Remove three shock absorber mounting block nuts from the mounting block.

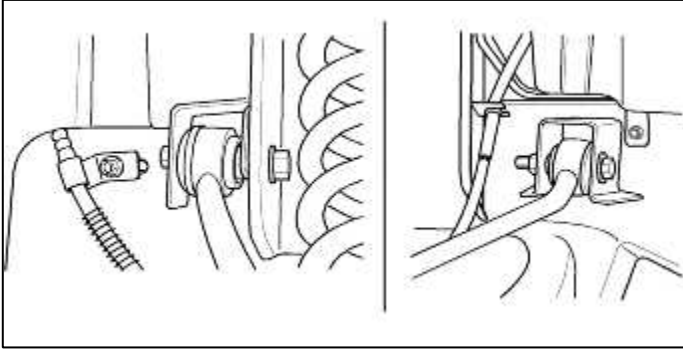


3. Raise the front of the vehicle and support it with safety stands.
4. Remove the front wheels.

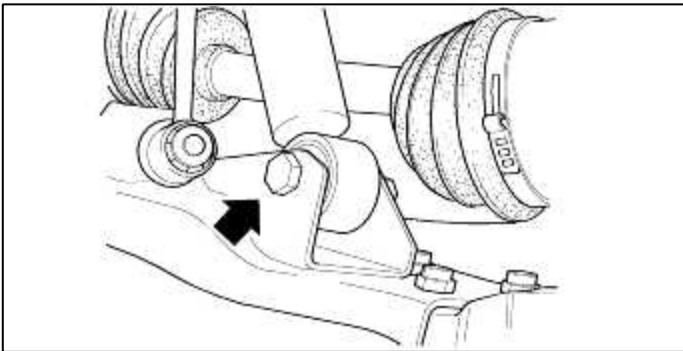
5. Remove the bolt on the steering knuckle side that secures the upper arm ball joint.



6. Remove the brake hose bracket and then the remove the upper arm bolts and nuts.



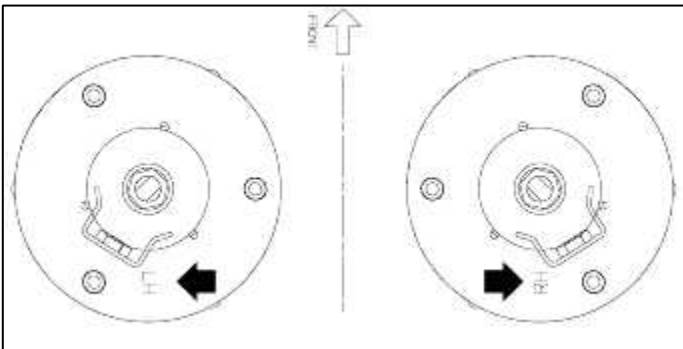
7. Remove the shock absorber lower nut.



8. Remove the spring and shock absorber assembly from the vehicle as an assembly.

## INSTALLATION

1. After making sure identification mark on the spring seat. Position the spring and shock absorber assembly into the upper mounting block.

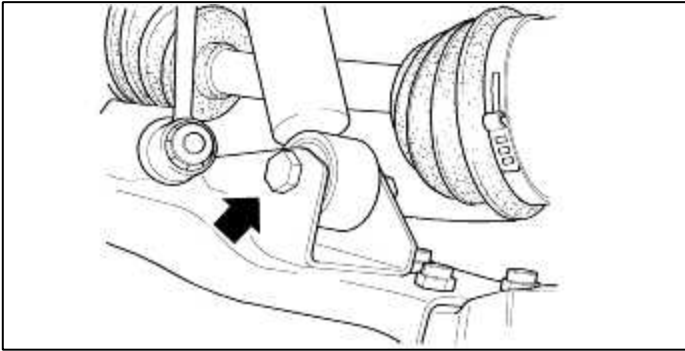


2. Install the mounting block nuts by 3-4 threads only.
3. Insure the front of the vehicle is raised and supported with safety stands.

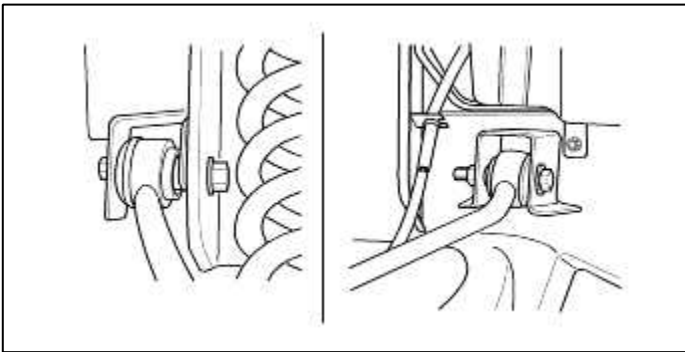
4. Tighten the lower nut of the shock absorber.

Tightening torque:

122-140 N·m (12.2-14 kg·m, 88-101 lb·ft).



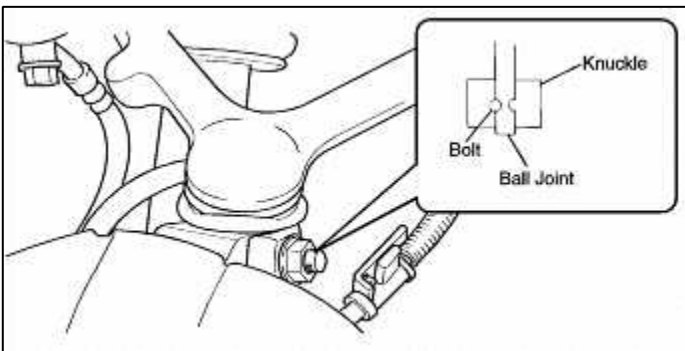
5. Position the upper arm to the frame brackets, insert the bolts and hand tighten the nuts.



6. Install the upper arm ball joint into the top of the steering knuckle and tighten the side bolt and nut.

Tightening torque:

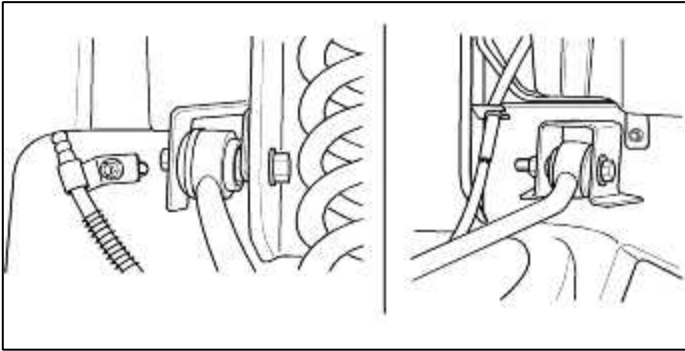
44-55 N·m (4.4-5.5 kg·m, 31-39 lb·ft).



7. Tighten the upper arm bolts and nuts and then install brake hose brackets.

Tightening torque:

76-95 N·m (7.6-9.5 kg·m, 54-68 lb·ft).



8. Install the wheels and secure with lock nuts.

Tightening torque:

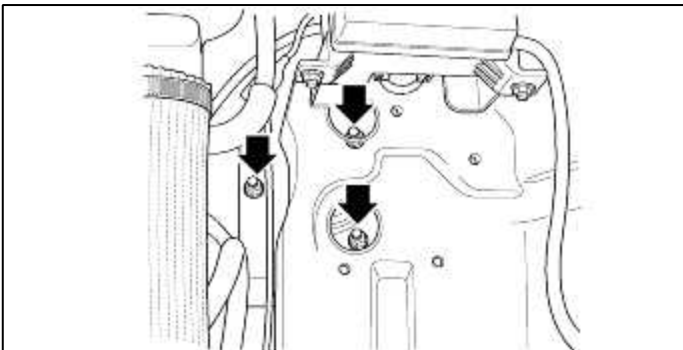
90-120 N·m (9-12 kg·m, 65-86 lb·ft).

9. Lower the vehicle.

10. Tighten the mounting block nut.

Tightening torque:

44-55 N·m (4.4-5.5 kg·m, 31-39 lb·ft).



11. Install the battery mounting bracket and the battery.  
 12. After installing the front shock absorber and coil spring assembly, measure the wheel alignment and adjust if necessary.

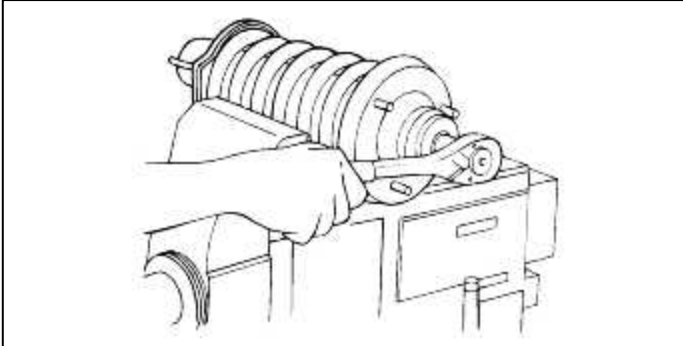
## DISASSEMBLY

1. Secure the shock absorber in a suitable vise.

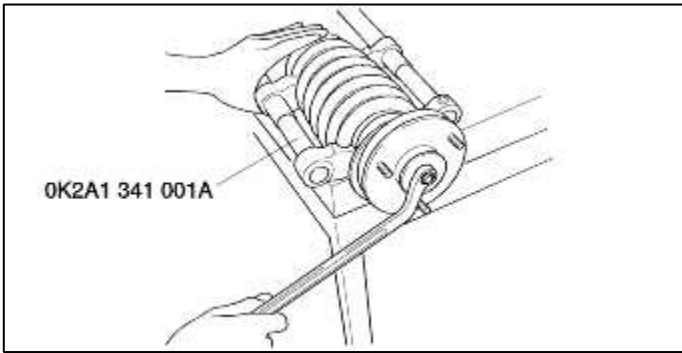
2. Loosen the piston rod nut several turns.

**NOTE**

- Use copperplate in the jaws of the vise to protect the shock absorber bottom bracket.
- Remove the piston rod nut until coil spring is compressed and secured.

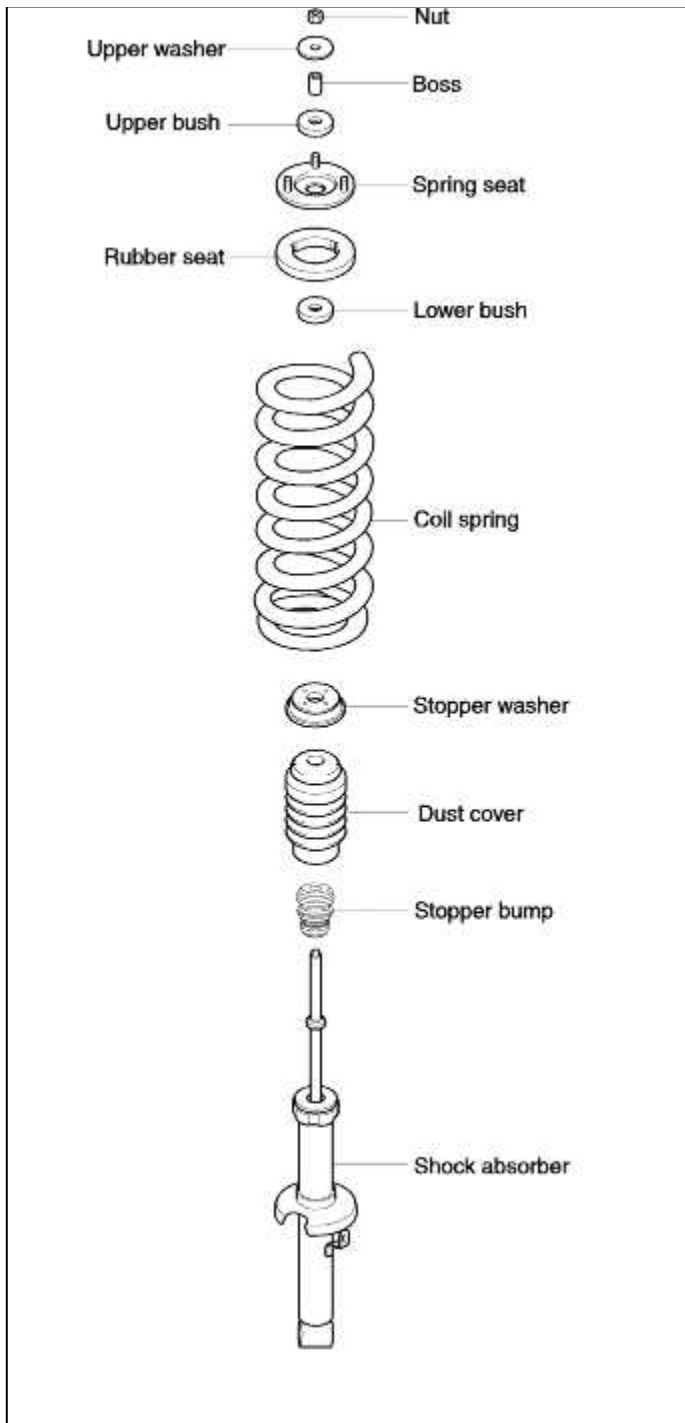


3. While still secured in a vise, compress the coil spring with SST.



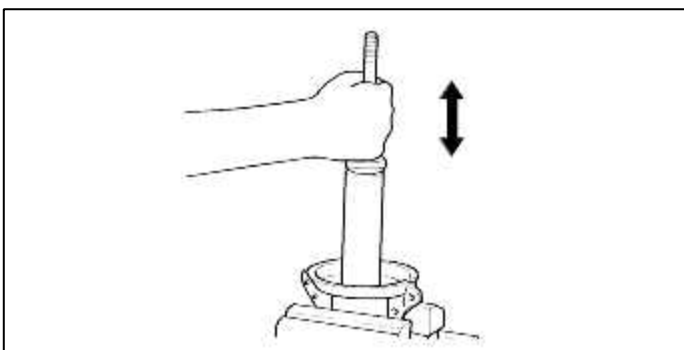
4. Remove the piston rod nut and each part as below.





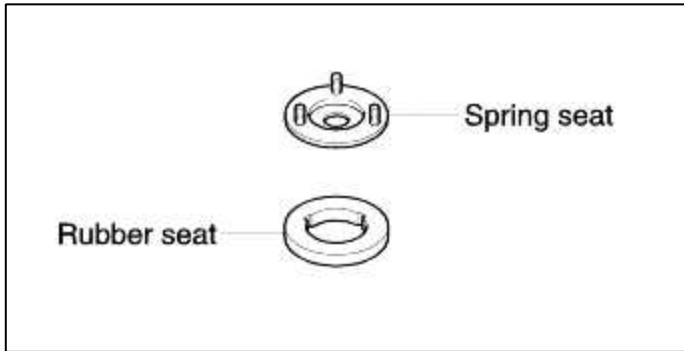
## INSPECTION/REBUILD

1. Secure a handle to the shock absorber piston rod and compress and lift the rod three times with a constant speed. Inspect for uniform working force and abnormal noise.



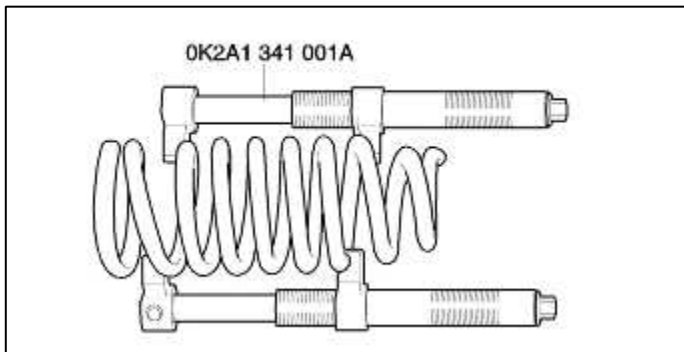
2. Inspect the entire shock absorber for signs of oil leakage; replace if required.
3. Inspect the coil spring for stress cracks and/or other damage.

4. Inspect for damage or deterioration of the upper and lower bushes.
5. Inspect for damage or tearing of the spring seat and rubber seat.



## REASSEMBLY

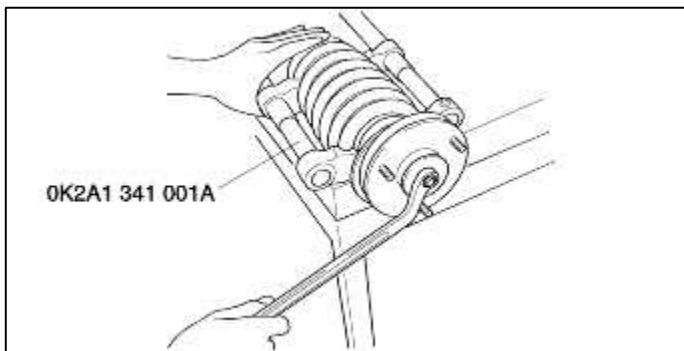
1. Secure the bottom portion of the shock absorber in a vise and compress the coil spring with SST.



### NOTE

Use copperplate in the jaws of the vise to protect the shock absorber bottom bracket.

2. Set the end of the coil spring to the rubber seat and install the coil spring.
3. Assemble stopper bump, dust cover, stopper washer, lower bush, rubber seat, spring seat, boss, upper bush and upper washer in sequence.
4. Hand tighten the piston rod nut.

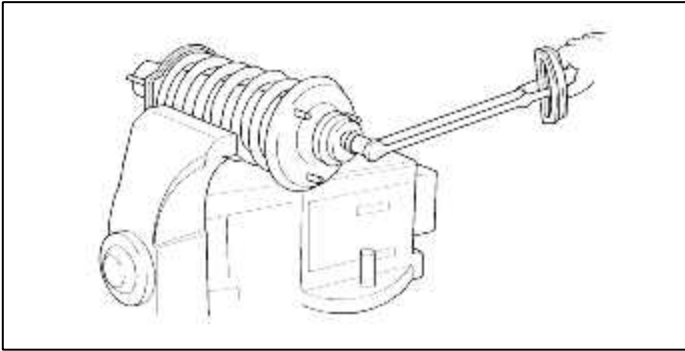


5. Carefully loosen the coil spring compressor and remove it.

6. With the bottom bracket of the shock absorber still in the vice, tighten the piston rod nut.

Tightening torque:

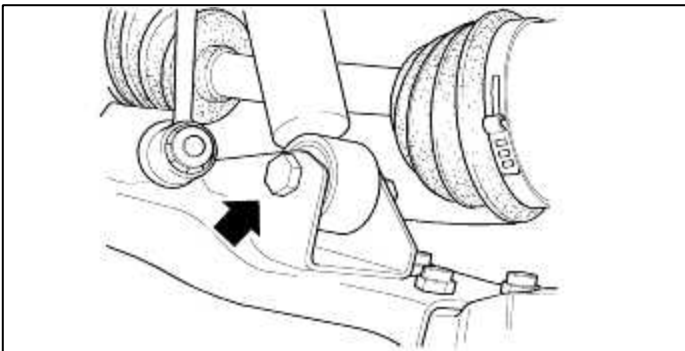
76-95 N·m (7.6-9.5 kg·m, 54-68 lb·ft).



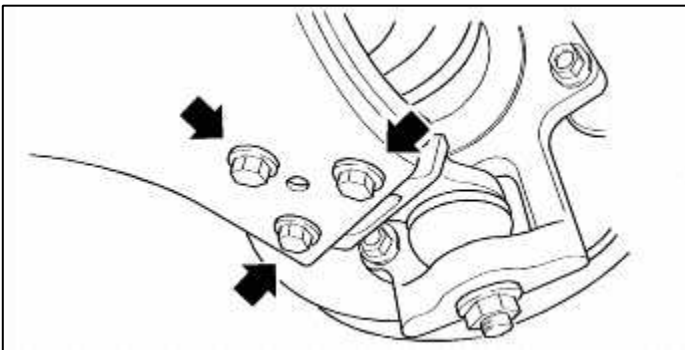
### Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

#### REMOVAL

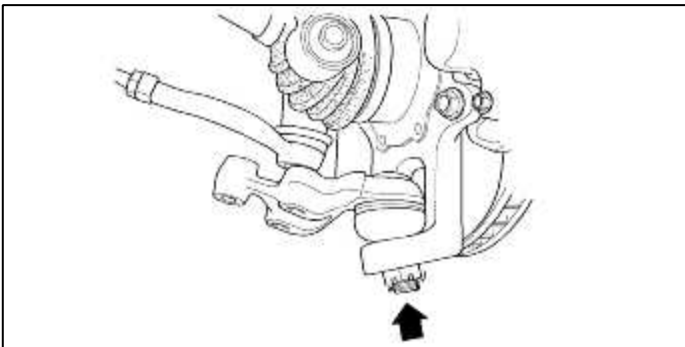
1. Raise the front of the vehicle and support it with safety stands.
2. Remove the front wheels.
3. Remove the lower nut of control link of stabilizer bar.
4. Remove the lower nut of shock absorber.



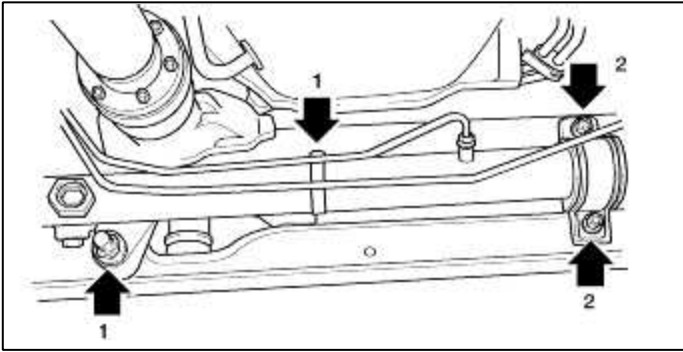
5. Remove the bolts and nuts that joins lower arm and lower arm ball joint.



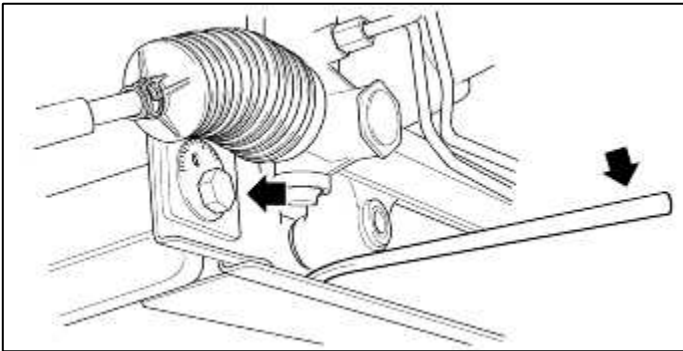
6. Remove the cotter pin and castle nut from the lower arm ball joint.



7. Remove the lower arm ball joint from the steering knuckle with SST.
8. Remove the steering gear mounting bolts and nuts.

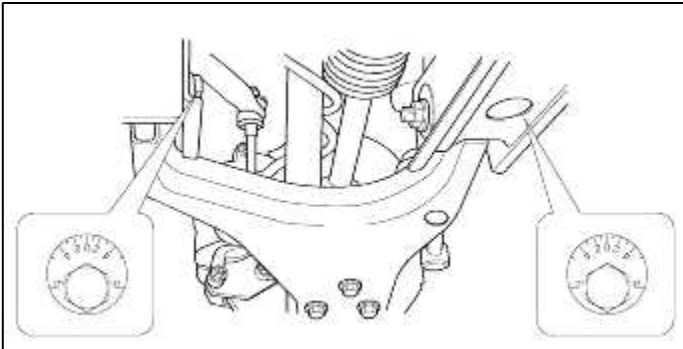


9. Remove the spindle from the front frame crossmember brackets during raising the steering gear box by using suitable bar.



#### NOTE

Before loosening the nuts of the spindles, make note of the numerical setting and mark the location on the frame bracket and plate so it can be re-installed to the same setting and location.



10. Remove the lower arm.

### BUSHING REPLACEMENT

1. For bushing removal, utilize a standard bearing press.
2. Install the new bushing using a standard bearing press.

#### NOTE

Apply lubricant to the new bushings prior to installation.

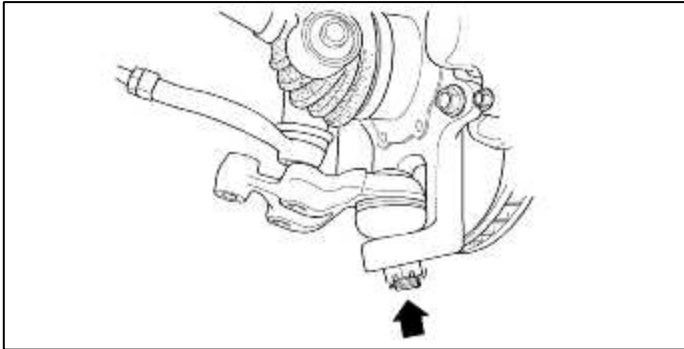
### INSTALLATION

1. Install the lower arm ball joint to the steering knuckle.

Tightening torque:

157-196 N·m (16-20 kg·m, 116-145 lb·ft).

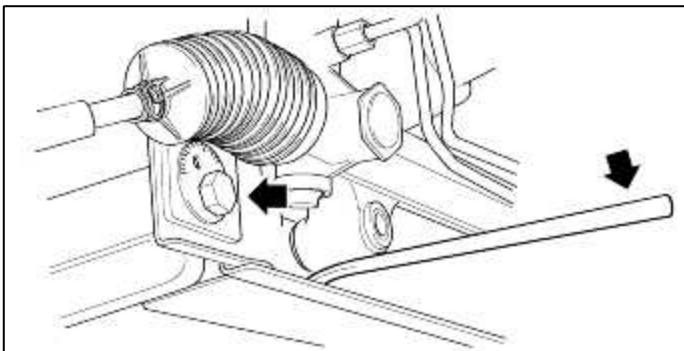
2. Install a new cotter pin through the castle nut.



3. Position the lower arm to the front frame crossmember brackets and then position the spindle during lift up the steering gear box by using suitable bar.
4. Install the lower arm spindles.

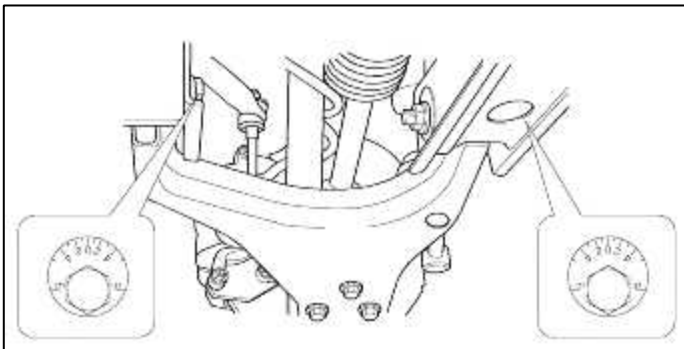
Tightening torque:

216-245 N·m (22-25 kg·m, 159-181 lb·ft).



**NOTE**

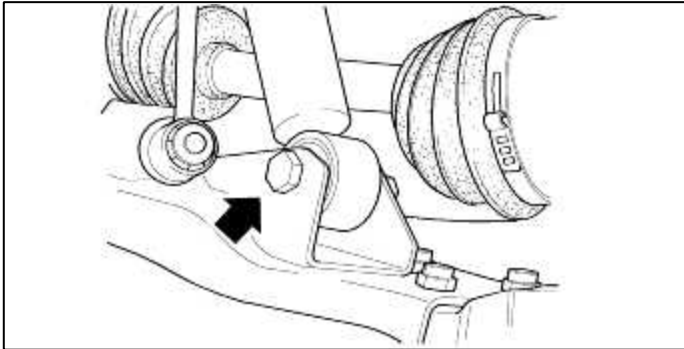
Align the spindle to the numerical setting and marked location on the frame bracket and plate so the same setting and location is maintained.



5. Install the lower nut of the shock absorber.

Tightening torque:

122-140 N·m (12.2-14 kg·m, 88-101 lb·ft).



6. Install the lower nut of control link of stabilizer bar.

Tightening torque:

95-117 N·m (9.5-11.7 kg·m, 68-84 lb·ft).

7. Install the wheels and secure the lock nuts.

Tightening torque:

90-120 N·m (9-12 kg·m, 65-86 lb·ft).

8. Remove the safety stands and lower the vehicle.

**NOTE**

After installation, measure the wheel alignment and adjust if necessary. Refer to "Wheel Alignment" in this section.

## INSPECTION

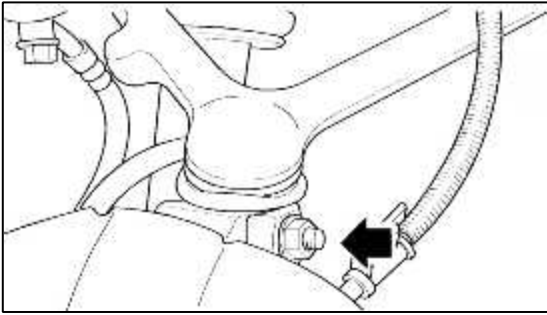
1. Inspect for worn or deteriorated lower arm bushings.
2. Inspect for bent, cracked or damaged lower arm.
3. Inspect for worn or damaged ball joint.
4. Replace if damaged, deformed or cracked; replace bushing if worn or deteriorated. Refer to "Bushing Replacement" in the following procedure.

## Suspension System > Front Suspension System > Front Upper Arm > Repair procedures

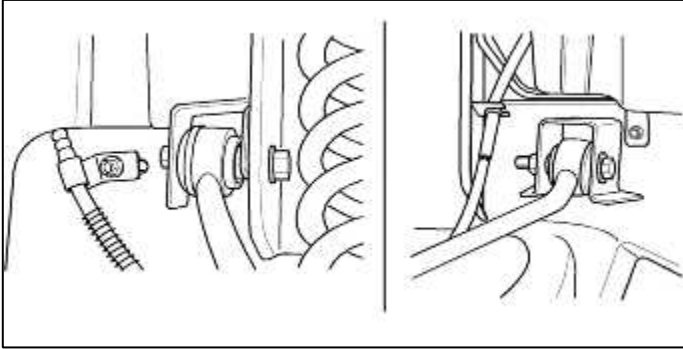
### REMOVAL

1. Raise the front of the vehicle and support it with safety stands.
2. Remove the front wheels.

3. Remove the bolt on the steering knuckle side that secures the upper arm ball link.



4. Remove the brake hose bracket and then remove the upper arm bolts and nuts.



## REPLACING THE BUSHING

1. Secure the upper arm in a suitable vise.
2. Using a standard bearing press, remove the old bushing.
3. Install the new bushing and then press it into the upper arm with a standard bearing press.

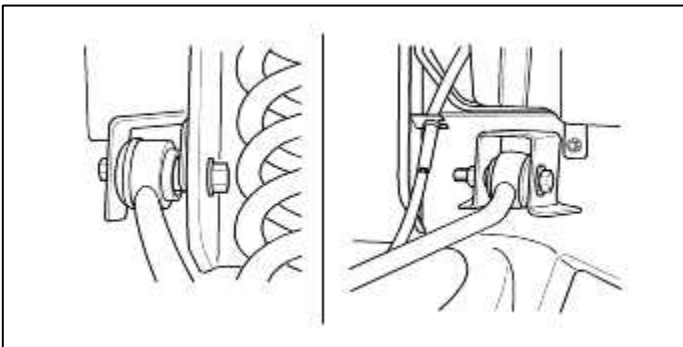
### NOTE

Apply lubricant to the new bushings to facilitate insertion into the upper arm.

The upper arm ball joint link and dust boot are non-replaceable items. Replace the upper arm if these items are damaged and/or deteriorated.

## INSTALLATION

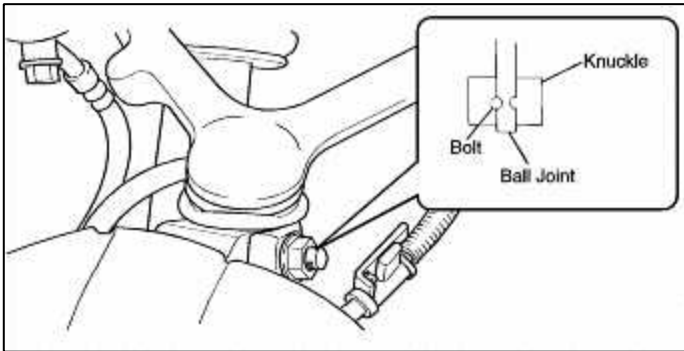
1. Raise the front of the vehicle and support it with safety stands.
2. Position the upper arm to the frame brackets, insert the bolts and hand tighten the nuts.



3. Install the upper arm ball joint into the top of the steering knuckle and tighten the side bolt and nut.

Tightening torque:

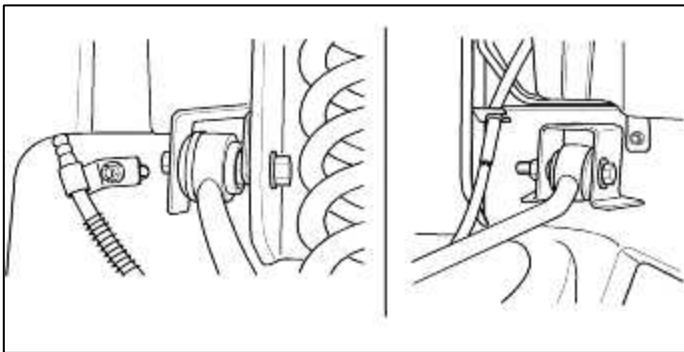
44-55 N·m (4.4-5.5 kg·m, 31-39 lb·ft).



4. Tighten the upper arm bolts and nuts and then install brake hose brackets.

Tightening torque:

76-95 N·m (7.6-9.5 kg·m, 54-68 lb·ft).



5. Install the wheels and secure with lock nuts.

Tightening torque:

90-120 N·m (9-12 kg·m, 65-86 lb·ft).

#### NOTE

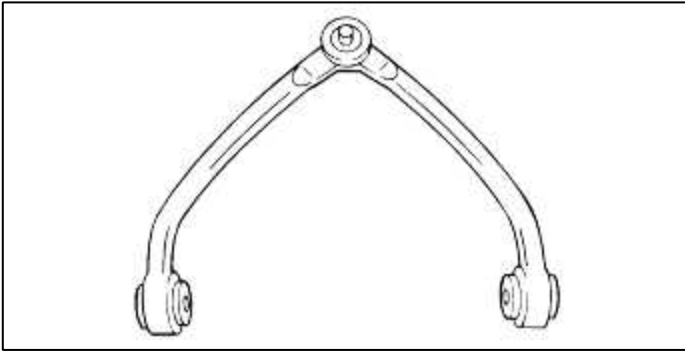
After installation, measure the wheel alignment and adjust if necessary. Refer to "Wheel Alignment" in this section.

#### INSPECTION

1. Inspect for bent, cracked or otherwise damaged upper arm.
2. Inspect for worn or deteriorated upper arm bushing.
3. Inspect for worn or damaged ball link and replace if damaged, deformed or cracked.



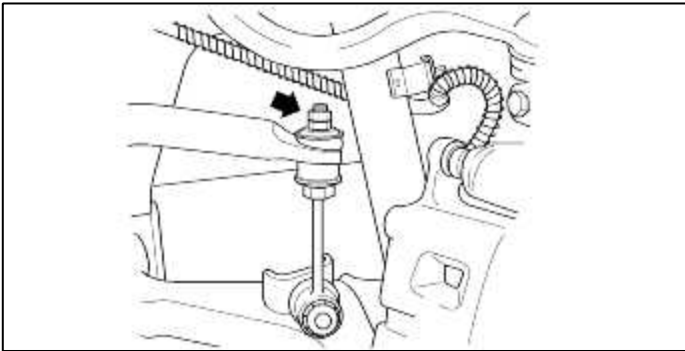
4. Replace bushings if worn or deteriorated. Refer to "Replacing the Bushing" in the following procedure.



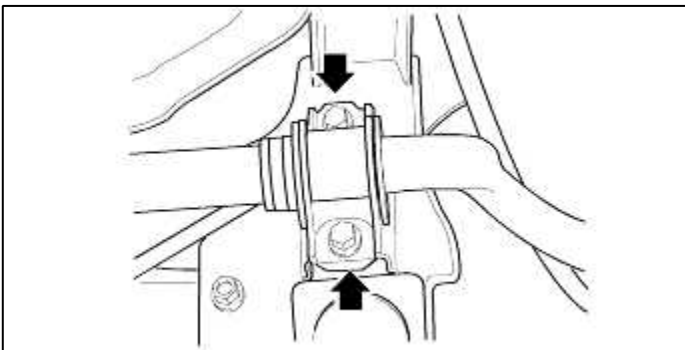
### **Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures**

#### **REMOVAL**

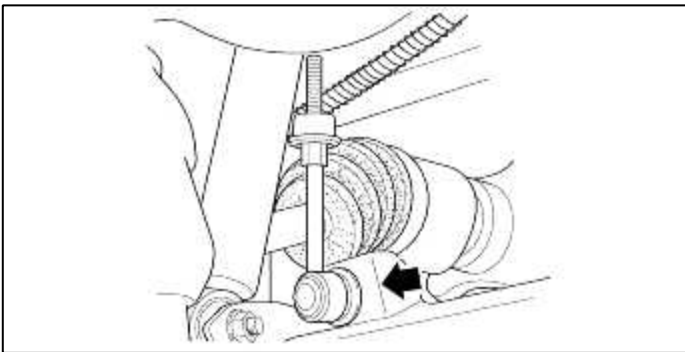
1. Raise up the front of the vehicle and support it with safety stands.
2. Remove the wheels.
3. Remove the undercover.
4. Remove the nuts and oil damper rubbers of control link.



5. Remove the stabilizer bar bushing brackets and then remove the stabilizer bar.



6. Remove the control link from the lower arm.



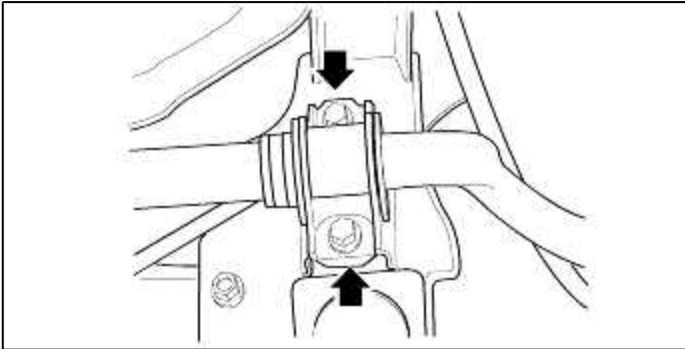
#### **INSTALLATION**

1. Position the control links to the lower arm.
2. Loosely tighten the control link nuts.

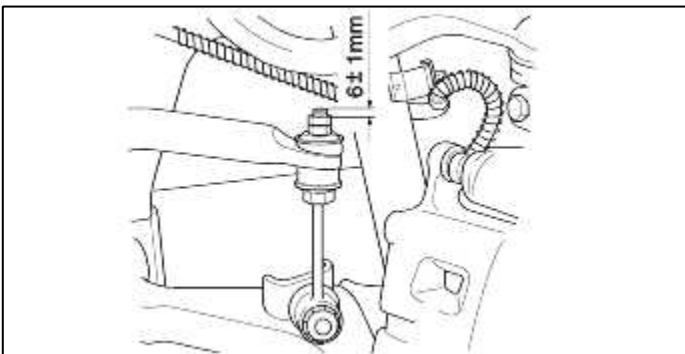
3. Install the stabilizer bar on the control link.
4. Align the clamp bushing inside of stabilizer bushing and install bracket.

Tightening torque:

44-55 N·m (4.4-5.5 kg·m, 31-39 lb·ft).



5. Install the oil damper rubber and nut, and then tighten to the specified length.



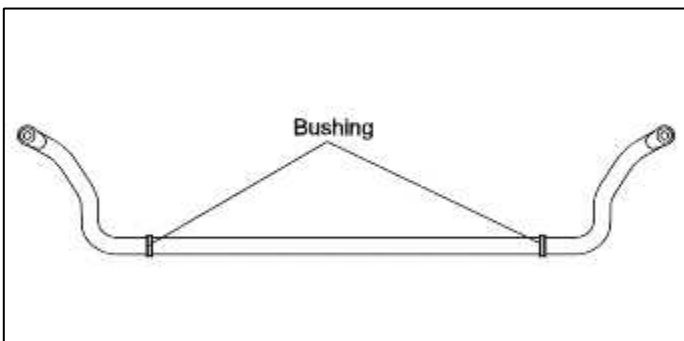
6. Tighten the lower nut of control link.

Tightening torque:

95-117 N·m (9.5-11.7 kg·m, 68-84 lb·ft).

## INSPECTION

1. Inspect for bent, cracked or damaged stabilizer bar.
2. Inspect for worn or deteriorated stabilizer bar bushing.



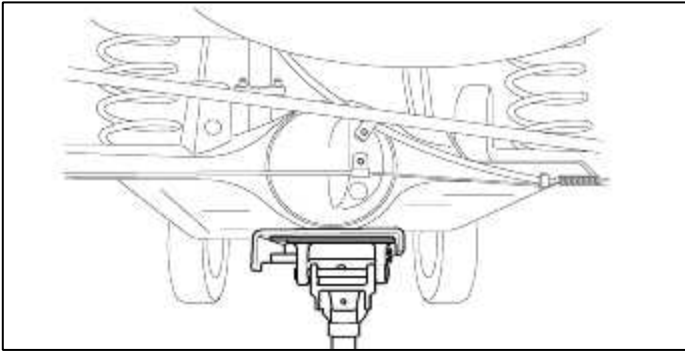
3. Inspect for worn or damaged ball joint of control link.

**Suspension System > Rear Suspension System > Rear Shock Absorber > Repair procedures**

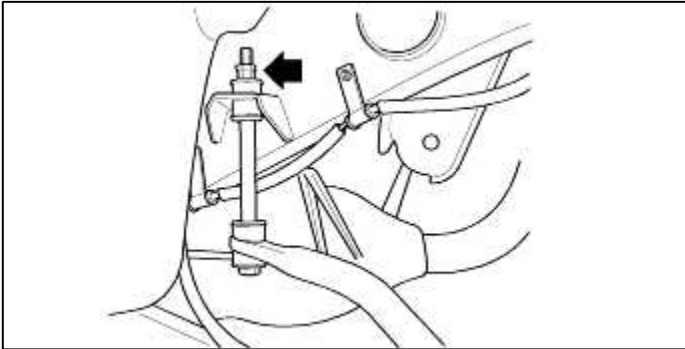
## REMOVAL

1. Raise the rear of the vehicle and support it with safety stands.
2. Remove the rear wheels.

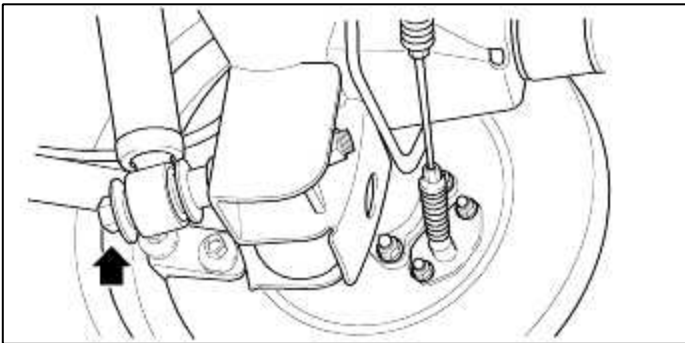
3. Raise the rear axle housing to facilitate removal of the shock absorbers.



4. Remove stabilizer link upper mounting nut.

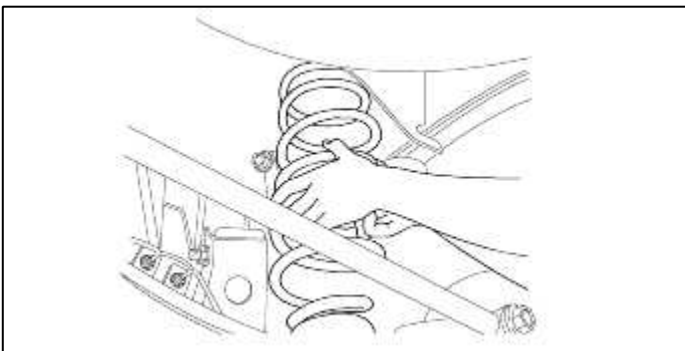


5. Remove the rear shock absorber lower nut and washer.



6. Remove the shock absorber upper bolt, and then remove the shock absorber.

7. Lower the rear axle housing slowly to facilitate removal of the coil spring.



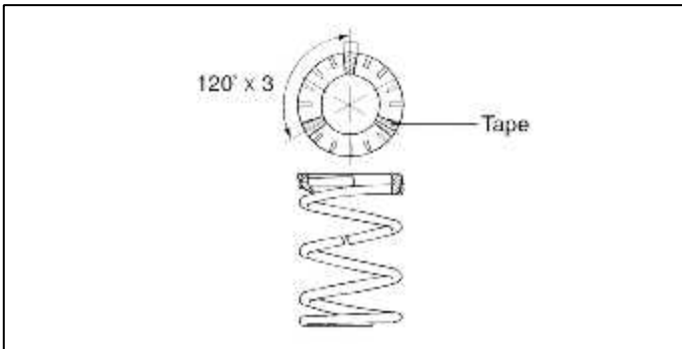
8. Remove the upper rubber seat.

## INSTALLATION

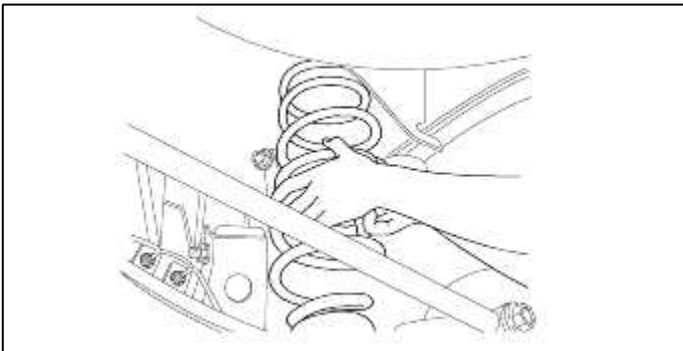
1. Position the upper rubber seat to the coil spring.

**CAUTION**

Align the spring end with the groove of the spring pad and fix the spring and the spring pad by adhering the 3 parts with tape.



2. Slowly raise the rear axle housing while installing the coil spring.



3. Install the shock absorber upper nut.

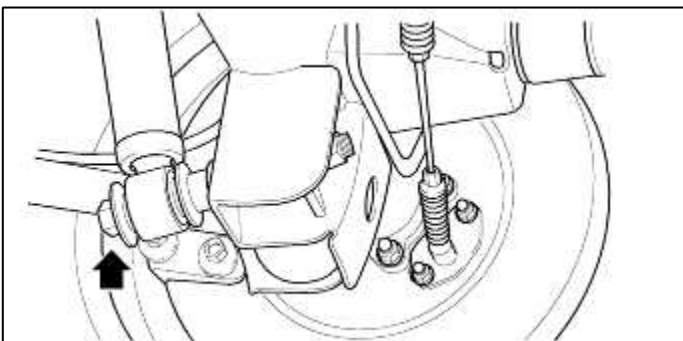
Tightening torque:

122-140 N·m (12.2-14 kg·m, 88-101 lb·ft).

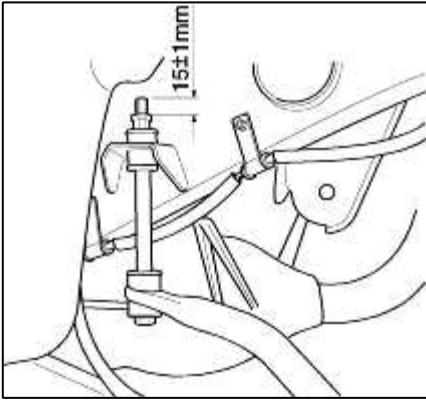
4. Install the shock absorber lower bolt.

Tightening torque:

122-140 N·m (12.2-14 kg·m, 88-101 lb·ft).



5. Install the stabilizer link upper mounting nut to the specified length.



6. Install the wheels and secure with lug nuts.

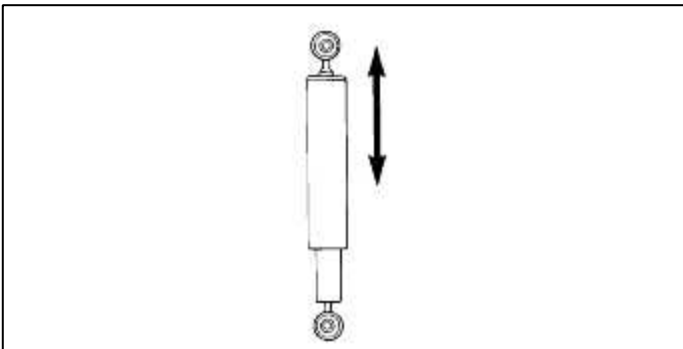
Tightening torque:

90-120 N·m (9-12 kg·m, 65-86 lb·ft).

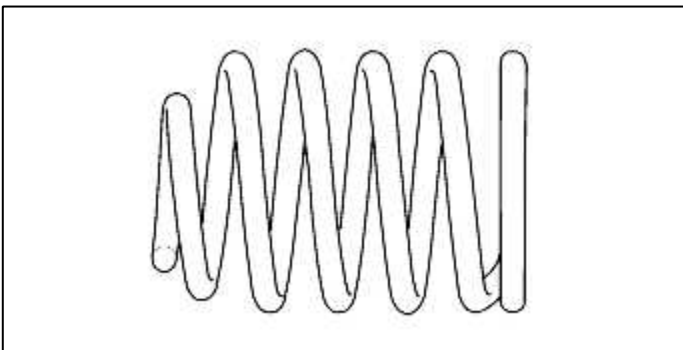
7. Remove the safety stands and lower the vehicle.

#### INSPECTION

1. Compress and expand the shock absorber three to four times and analyze for uniform working force and abnormal noise.
2. Inspect for gas leakage.



3. Inspect the shock absorber for a worn or deteriorated rubber bushing.
4. Replace the rear shock absorber assembly if a problem is found.
5. Inspect the rear coil spring for bends, cracks or other damage.

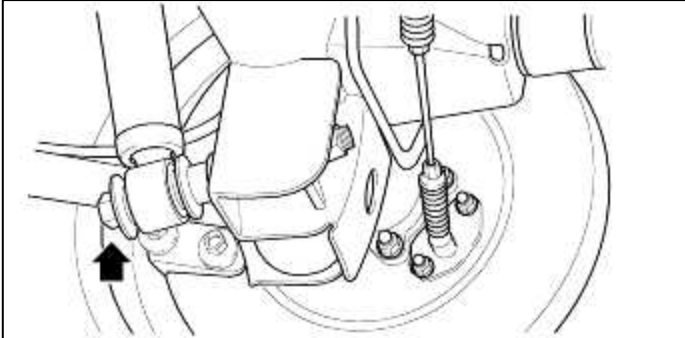


6. Inspect the upper rubber seats for tears and/or deterioration.
7. Inspect the rear jounce stop for damage and/or deterioration.
8. Replace if damaged, deformed or cracked; replace bushings if worn or deteriorated.

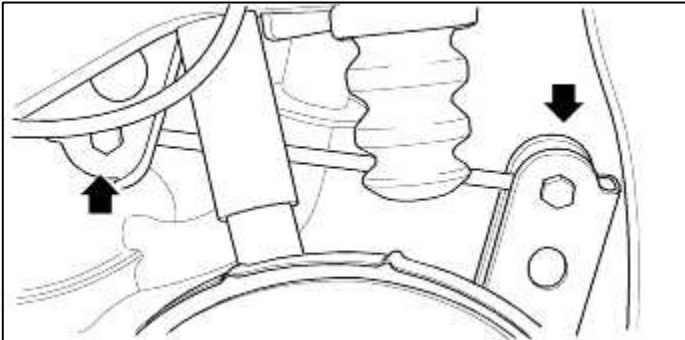
## REAR UPPER ARM

### Removal

1. Raise the rear of the vehicle and support it with safety stands.
2. Remove the rear wheels.
3. Raise the rear axle housing to facilitate removal of the upper arm.
4. Remove shock absorber lower bolt.

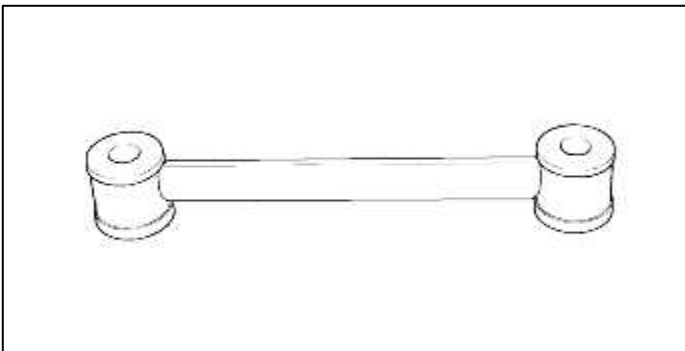


5. Loosen the upper arm bolts and remove the upper arm.



### Inspection

1. Inspect the upper arm for bends, cracks and/or other damage.
2. Inspect the upper arm bushings for wear and/or deterioration.
3. Replace if damaged, deformed or cracked; replace bushings if worn or deteriorated. Refer to Bushing Replacement in the following procedure.



### Bushing Replacement

1. Press out the bushing using a standard bearing press.
2. Apply soapy water to the bushing and press into place using a standard bearing press.

### Installation

1. Install the upper arm and the bolts.

---

Tightening torque:

122-140 N·m (12.2-14 kg·m, 88-101 lb·ft).

---

2. Install shock absorber lower bolt.

Tightening torque:

122-140 N·m (12.2-14 kg·m, 88-101 lb·ft).

3. Lower the rear axle housing.
4. Install the wheels and secure with lug nuts.

Tightening torque:

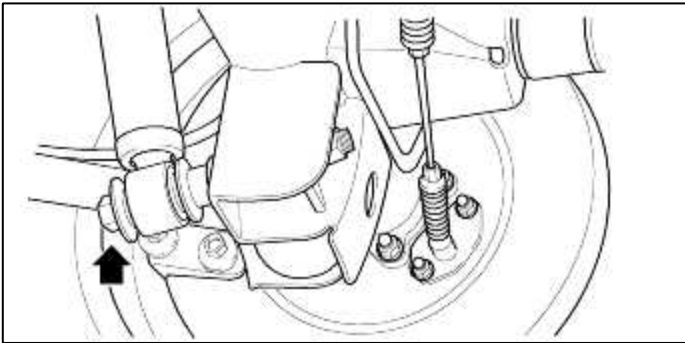
90-120 N·m (9-12 kg·m, 65-86 lb·ft).

5. Remove the safety stands and lower the vehicle.

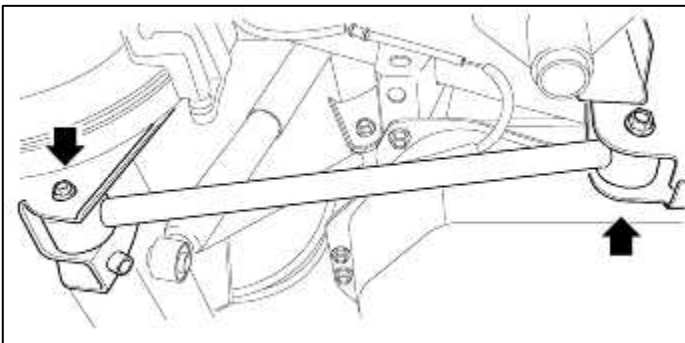
## REAR LOWER ARM

### Removal

1. Raise the rear of the vehicle and support it with safety stands.
2. Remove the rear wheels.
3. Raise the rear axle housing to facilitate removal of the lower arm.
4. Remove shock absorber lower bolt.



5. Remove wheel speed sensor cable from rear lower arm.
6. Loosen the lower arm bolts and remove the lower arm.



### Inspection

1. Inspect the lower arm for bends, cracks and/or other damage.
2. Inspect the lower arm bushings for wear and/or deterioration.
3. Replace if damaged, deformed or cracked; replace bushings if worn or deteriorated. Refer to Bushing Replacement in the following procedure.

### Bushing Replacement

1. Press out the bushing using a standard bearing press.
2. Apply lubricant to the bushing and press into place using a standard bearing press.

### Installation

1. Install the lower arm and the bolts.

Tightening torque:

137-157 N·m (14-16 kg·m, 101-116 lb·ft).

2. Install wheel speed sensor cable to the rear lower arm.
3. Install shock absorber lower bolt.

Tightening torque:

122-140 N·m (12.2-14 kg·m, 88-101 lb·ft).

4. Lower the rear axle housing.
5. Install the wheels and secure with lug nuts.

Tightening torque:

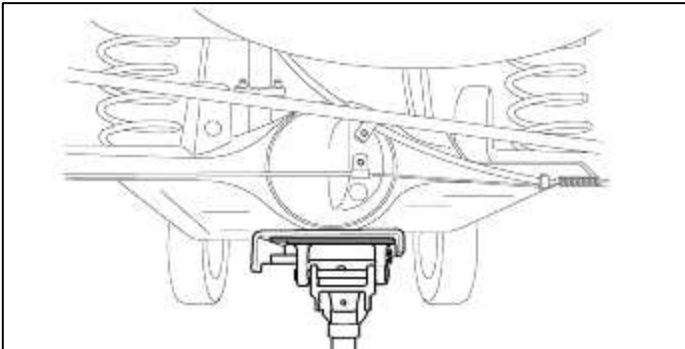
90-120 N·m (9-12 kg·m, 65-86 lb·ft).

6. Remove the safety stands and lower the vehicle.

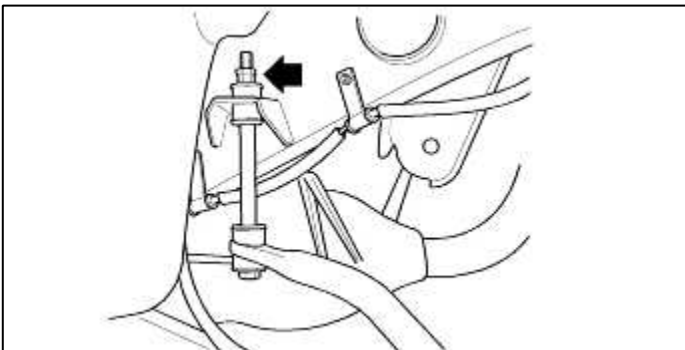
### **Suspension System > Rear Suspension System > Rear Stabilizer Bar > Repair procedures**

#### **REMOVAL**

1. Support the bottom of the rear differential carrier with a jack.

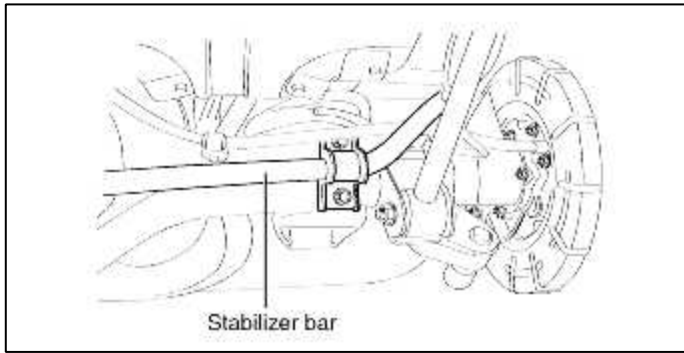


2. Remove the stabilizer link mounting nut.





3. Remove the stabilizer bar bushing bracket.

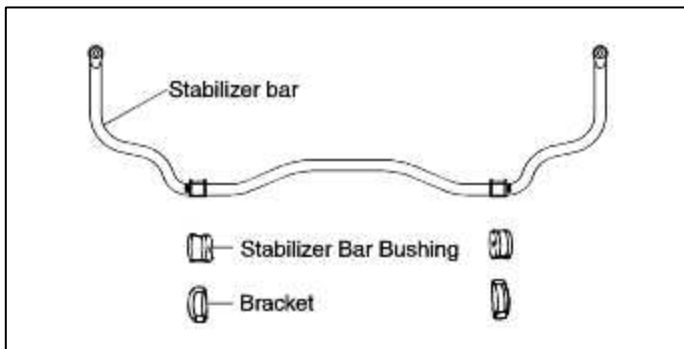


## INSTALLATION

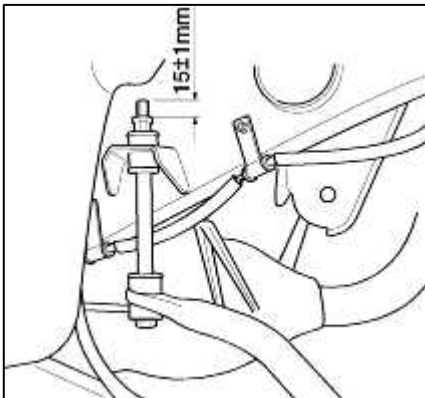
1. Align the identification mark white paint on stabilizer bar with bushing and install the stabilizer bar bushing bracket.

Tightening torque:

19 - 23N·m (1.9-2.3 kg·m, 13-16lb·ft)



2. Install the joint cup and nut and then tighten to the specified length.



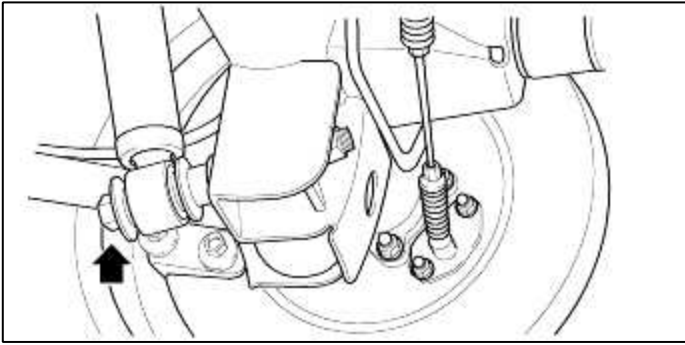
## Suspension System > Rear Suspension System > Lateral Rod > Repair procedures

### LATERAL ROD

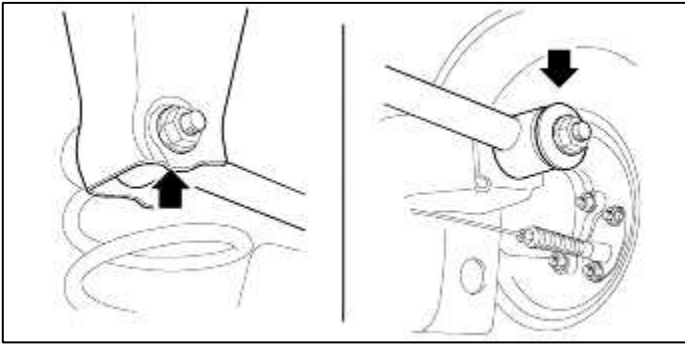
#### Removal

1. Raise the rear of the vehicle and support it with safety stands.
2. Remove the rear wheels.
3. Raise the rear axle housing to facilitate removal of the lateral rod.

4. Remove shock absorber lower bolt.

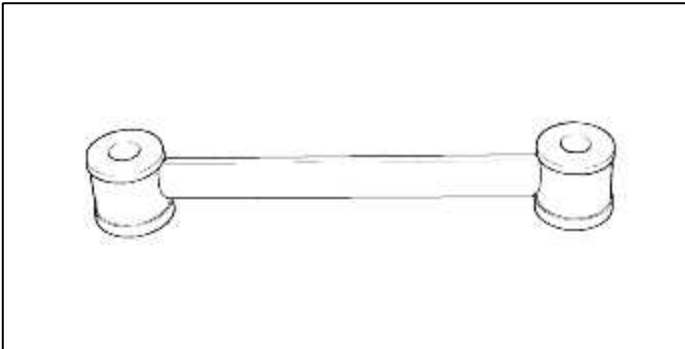


5. Loosen the lateral rod bolts and remove the lateral rod.



#### Inspection

1. Inspect the lateral rod for bends, cracks and/or other damage.



2. Inspect the lateral rod bushings for wear and/or deterioration.
3. Replace if damaged, deformed or cracked; replace bushings if worn or deteriorated. Refer to "Bushing Replacement" in the following procedure.

#### Bushing Replacement

1. Press out the bushing using a standard bearing press.
2. Apply lubricant to the bushing and press into place using a standard bearing press.

#### Installation

1. Install the lateral rod and the bolts.

---

Tightening torque:

187-215 N·m (18.7-21.5 kg·m, 135-155 lb·ft).

---

2. Install shock absorber lower bolt.

---

Tightening torque:

122-140 N·m (12.2-14.0 kg·m, 88-101 lb·ft).

---

3. Lower the rear axle housing.

4. Install the wheels and secure with lug nuts.

Tightening torque:

90-120 N·m (9-12 kg·m, 65-86 lb·ft).

5. Remove the safety stands and lower the vehicle.

### **Suspension System > Tires/Wheels > Tire > Repair procedures**

#### **TIRE WEAR**

1. Measure the tread depth of the tire.

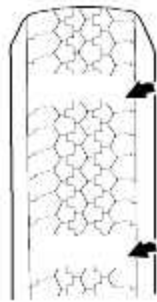
Tread depth of tire (Limit) :

1.6 mm (0.0630 in.)

2. If the tread depth is less than the limit, replace the tire.

#### **NOTE**

When the tread depth of the tire is reduced to 1.6 mm(0.0630 in.) or less, the wear indicators will appear.



### **Suspension System > Tires/Wheels > Wheel > Repair procedures**

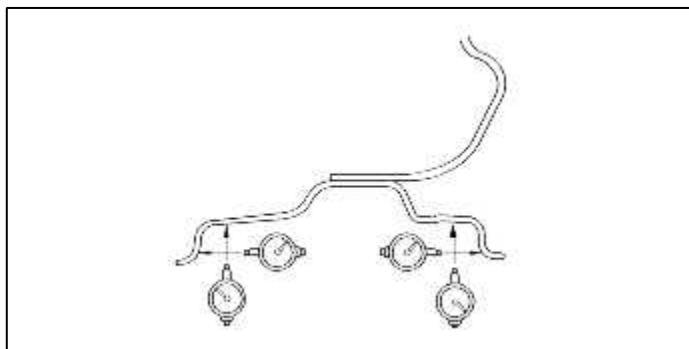
#### **WHEEL RUNOUT**

1. Jack up the vehicle and support it with jack stands.
2. Measure wheel runout with a dial indicator.

3. Replace the wheel if wheel runout exceeds the limit.

#### Wheel runout [Limit]

Direction	Aluminum wheel	Steel wheel
Radial	0.25 mm (0.0098 in.)	1.0 mm (0.039 in.)
Axial	0.25 mm (0.0098 in.)	1.2 mm (0.222 in.)



#### WHEEL NUT TIGHTENING

1. Tightening torque.

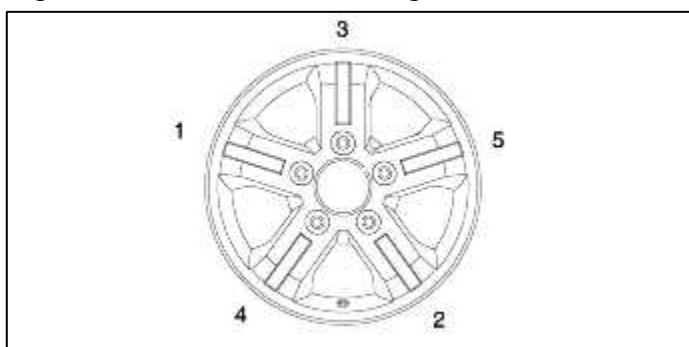
Tightening torque:

90-120 N·m (9-12 kg·m, 65-86 lb·ft).

#### CAUTION

When using an impact-wrench, adjust the tightening torque completely.

2. Tighten all the wheel nut according to the order shown in the illustration until they are all tight.



#### Suspension System > Tires/Wheels > Repair procedures

#### FRONT WHEEL ALIGNMENT

#### WARNING

PROVIDE SUFFICIENT SUPPORT FOR THE VEHICLE TO REDUCE THE POSSIBILITY OF THE VEHICLE FALLING, CAUSING PERSONAL INJURY OR DEATH.

Wheel alignment refers to the angular relationship between the wheels, control arms, suspension and the ground. It deals with tire camber, caster, toe-in and wheel balancing. Proper wheel alignment and wheel balance insures a safe, quiet ride with minimal tire wear. This section assumes that all components are in good working condition. Performing this exercise may also detect any problem areas in the front suspension. It is advisable to replace defective components before attempting a wheel alignment.

### Inspection

1. Inspect tires for proper balance and inflation. Balance tires and set to the recommended pressure if necessary.
2. Inspect front wheel bearing play and reduce the bearing play; replace any defective bearings.
3. Inspect for any excessive looseness of the ball joints and steering center link.
4. Place the vehicle on level ground and confirm that there are no passengers or luggage on board.
5. Push down on the front of the vehicle to determine the correct operation of the shock absorbers.

### CAMBER

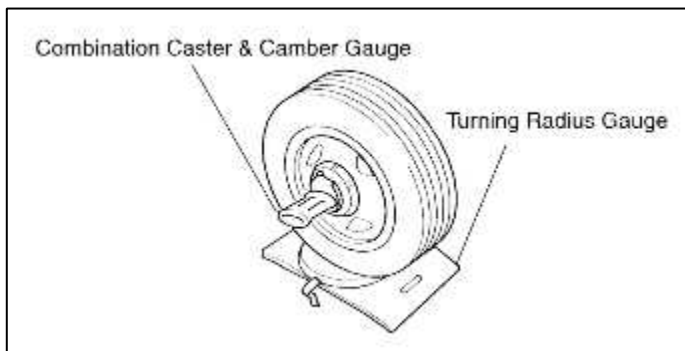
#### Inspection (Camber)

1. Position the vehicle so that the front wheel is on the turning-radius gauge.
2. Remove wheel cover.
3. Attach the standard camber gauge to the hub and measure the camber.

Camber:

$0.39^\circ \pm 0.5^\circ$  (No Passenger Load)

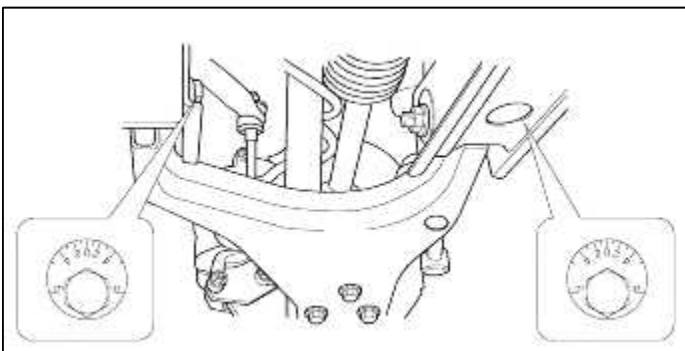
$0^\circ$  (2 Passenger Load)



#### Adjustment (Camber)

1. Turn the front spindle clockwise so that the number "1" mark is aligned with the vertical line on the spindle bracket.
2. Turn the rear spindle clockwise so that the number "1" mark is aligned with the vertical line on the spindle bracket.

Each numerical point indicated on the spindle increases the camber by 0.18 degrees when turned to the vertical line on the spindle bracket.

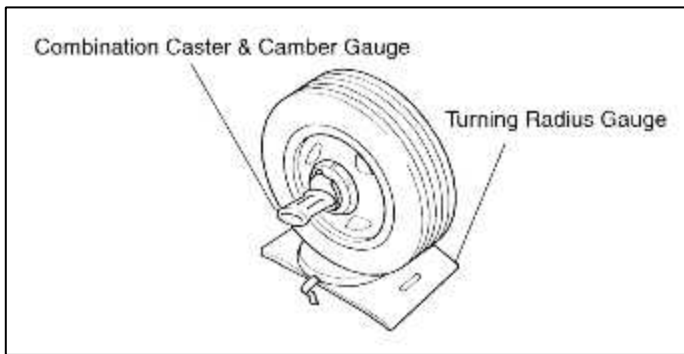


### CASTER

#### Inspection (Caster)

1. Position the vehicle so that the front wheel is on the turning-radius gauge.

2. Remove the wheel cover.



3. Attach a standard caster gauge to the hub and measure the caster.

Caster:

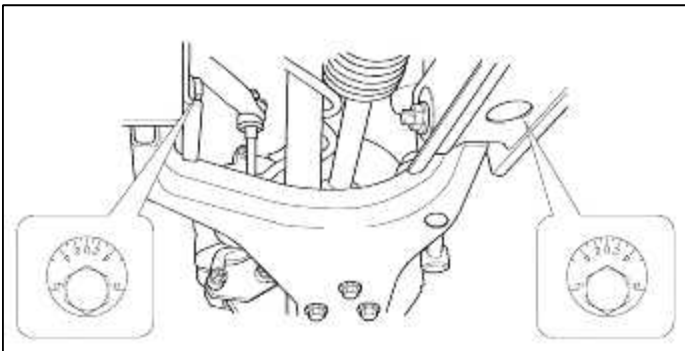
$3.30^\circ \pm 0.5^\circ$  (No Passenger Load)

$3.55^\circ$  (2 Passenger Load)

#### Adjustment (Caster)

1. Turn the front spindle clockwise until the number "1" mark is aligned with the vertical line on the spindle bracket.
2. Turn the rear spindle counter-clockwise until the number "1" mark is aligned with the vertical line on the spindle bracket.

Each numerical point indicated on the spindle increases the caster by 0.23 degrees when turned to the vertical line.



#### TOE-IN

#### INSPECTION (TOE-IN)

1. Position the vehicle on level ground and place the front wheels in a straight-ahead position within  $\pm 5$  degrees.

## 2. Measure the toe-in with a standard toe-in gauge.

Toe-in

Front

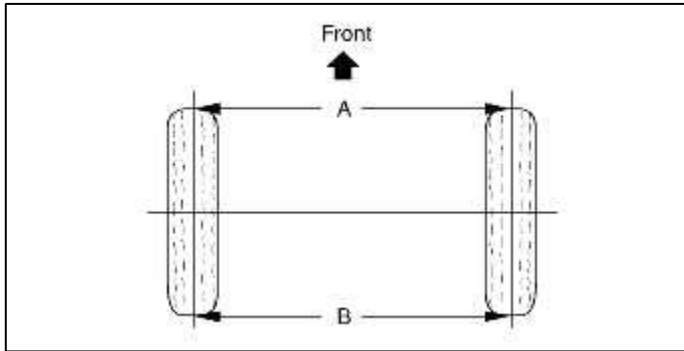
Total :  $0^\circ \pm 0.2^\circ$

Individual :  $0^\circ \pm 0.1^\circ$

Rear

Total :  $0^\circ \pm 0.2^\circ$

Individual :  $0^\circ \pm 0.1^\circ$



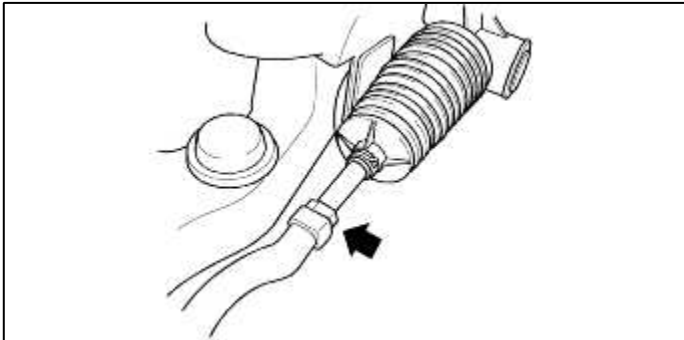
### ADJUSTMENT (TOE-IN)

1. Loosen the left and right tie-rod lock nuts.
2. Toe to specifications by turning the tie-rod by the center adjuster.
3. Tighten the left and right tie-rod lock nuts.

Tightening torque:

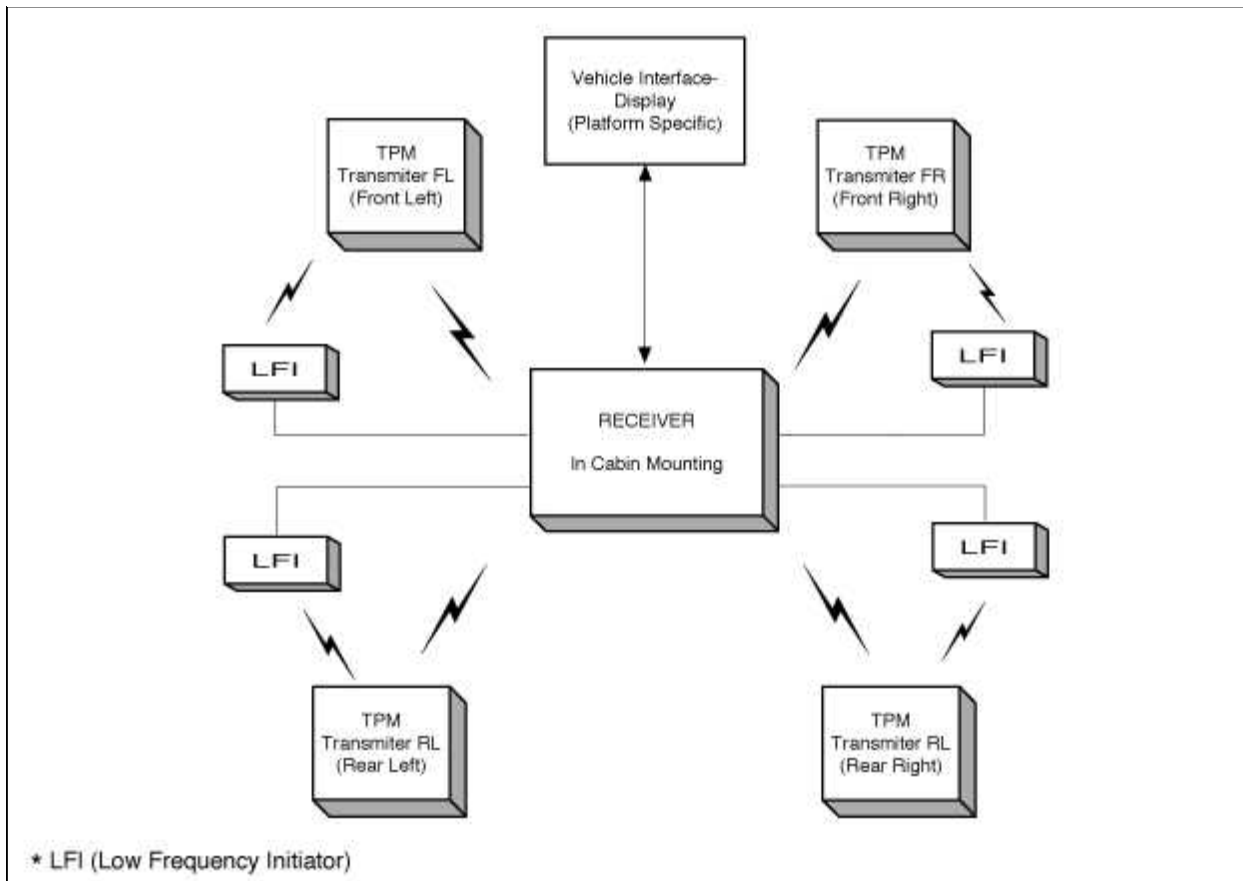
50-55 N·m (5.0-5.5 kg·m, 36-39 lb·ft).

## 4. Repeat adjustment instructions for opposite side.



**Suspension System > Tire Pressure Monitoring System > Schematic Diagrams**

### SCHEMATIC DIAGRAM

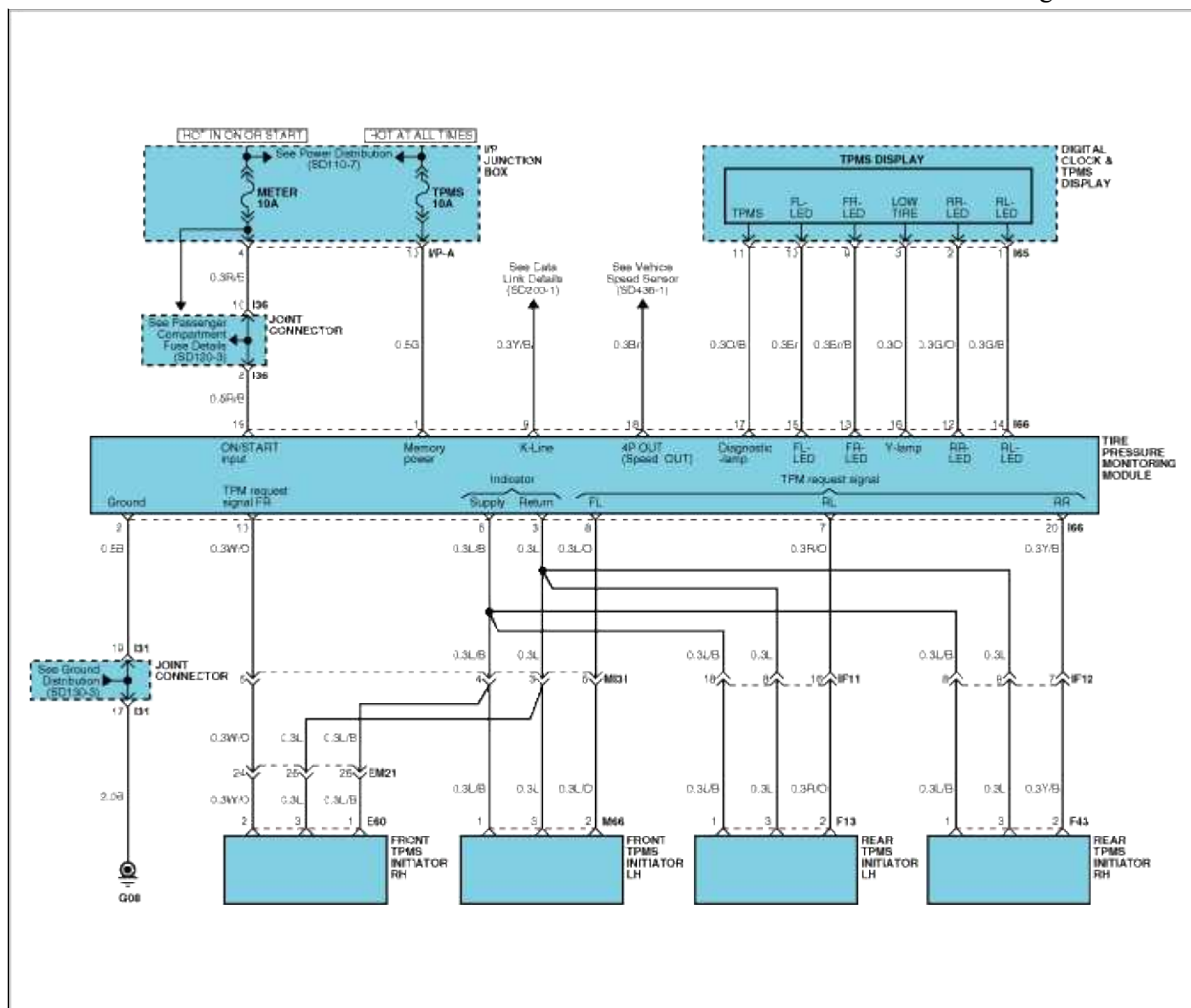


1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

NO	PIN-OUT ASSIGNMENT	NO	PIN-OUT ASSIGNMENT
1	Battery	11	-
2	Ground (TPMS receiver)	12	RR LED
3	Ground (Initiator)	13	FR LED
4	-	14	RL LED
5	LFI-Power supply	15	FL LED
6	-	16	TREAD lamp
7	RL LFI Signal	17	Diagnostic lamp (TPMS)
8	FL LFI Signal	18	Speed signal
9	K-LINE	19	Ignition 1(+)
10	FR LFI Signal	20	RR LFI Signal

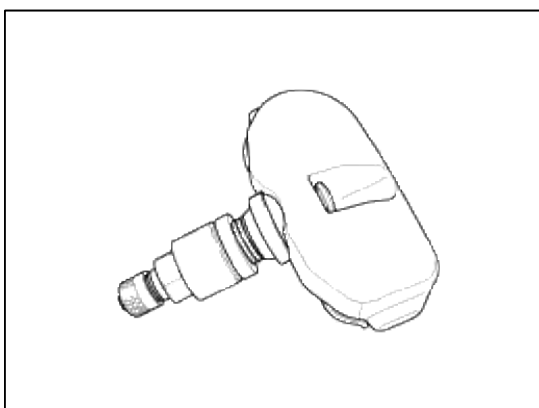
circuit diagram





## Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Description and Operation

### DESCRIPTION



## 1. Mode

### (1) Configuration State

- A. All sensors should be in the High Line (Auto) state.
- B. In High Line (Auto) configuration, sensor transmissions occur every 1 minute (nominal) and pressure is measured every 4 seconds.

### (2) Normal Delayed Auto State

- A. This is High Line specific and is used for all HMC/KMC High Line applications.
- B. In this state, the sensor will transmit for approx. 12 minutes before automatically entering storage state.

### (3) Storage Auto State

- A. This state is a Low quiescent current state.
- B. In this state;
  - 1) Ignition off.
  - 2) The sensor does not measure pressure / temperature / battery level.
  - 3) The sensor will not transmit, unless requested to do so by the initiate command.

### (4) Alert State

- A. The sensor automatically enters this state if the measured temperature exceeds 110°C and over temperature shutdown is likely.
- B. In this state, pressure is measured every 4 seconds and RF data transmitted every 4 seconds.
- C. The state lasts for 1 minute if it is pressure triggered.

## Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Repair procedures

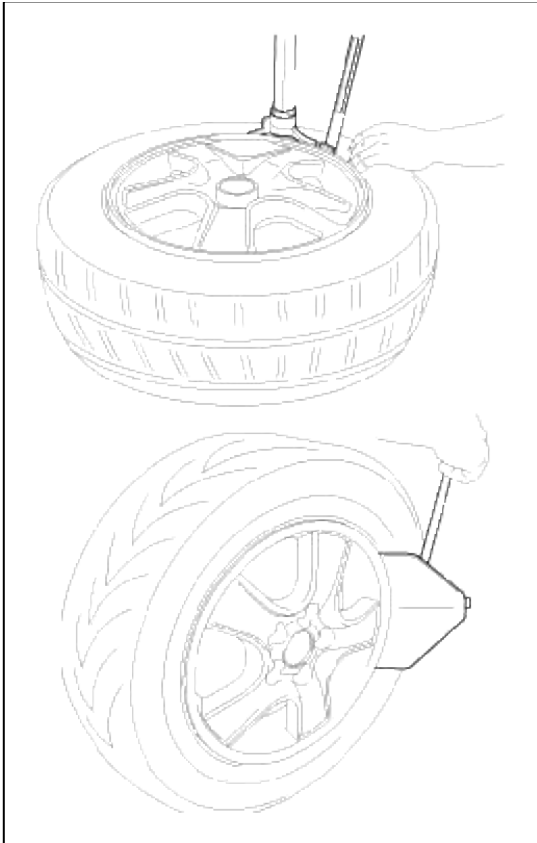
### REMOVAL

#### Tire Removal

1. Deflate tire & remove balance weights.

#### CAUTION

- The tire bead should be broken approx. 90° from the valve side of the wheel. The bead breaker should not be set too deep.
- Avoid tire/tool contact with the valve on dismount.
- Dismount should end near the valve.

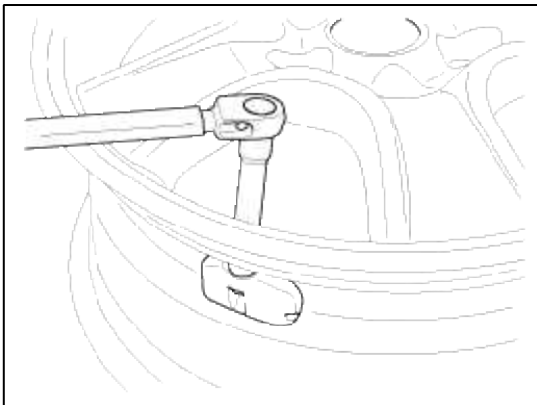


## Sensor Removal

### CAUTION

Handle the sensor with care.

1. Remove the valve nut.



### CAUTION

The valve nut should not be re-used.

2. Discard the valve assembly.

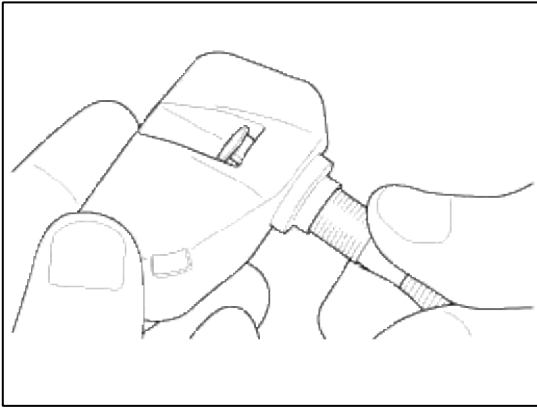
## INSTALLATION

### Sensor Fit

### CAUTION

- Handle the sensor with care.
- Avoid lubricant contact if possible.

1. Assemble valve to sensor and turn valve 3 times with the square part of the screw in the slot.

**CAUTION**

- The fit should not be tight i.e. it should still be possible to easily adjust valve angle.
- Ensure that the wheel to be fitted is designed for sensor mount. There should normally be a mark to indicate this.
- Ensure that the valve hole and mating face of the wheel are clean.

2. Mount assembly to wheel.

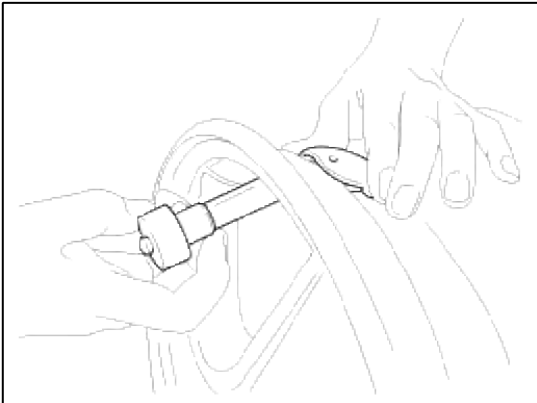
**CAUTION**

Ensure sensor feet are against the wheel throughout the remainder of the assembly process.

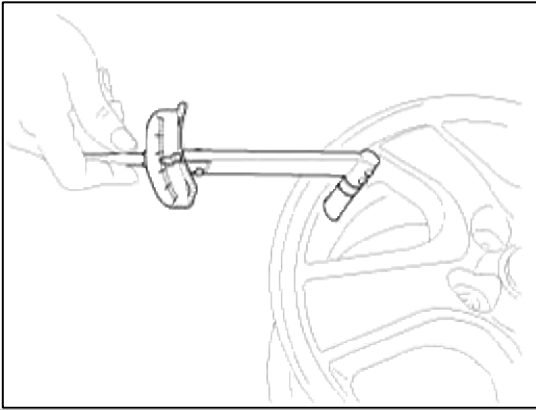
3. Tighten washer and nut by hand until the valve thread meets the nut built-in calibrated stop.

**CAUTION**

Ensure that the grommet remains in contact with the wheel.



4. Using a torque wrench, tighten the nut to  $2.95 \pm 0.37$  lb-ft ( $4.0 \pm 0.5$  Nm) It is normal to feel a break as the 1.7 lb-ft (2.3Nm) calibrated stop in the nut snaps and the torque falls.



#### CAUTION

- Increase torque smoothly in order to achieve a clean break of the stop.
- Do not exceed allowed torque.
- Do not use electric or pneumatic tools.

#### Tire Fit

#### CAUTION

Only use wheels designed to accommodate the TPMS sensor.

1. Lubricate the tire bead not the rim. Excessive lubrication should not be applied.
2. Start tire mounting approx. 5.9 in (15 cm) from valve.
3. Move the mounting tool away from the valve.

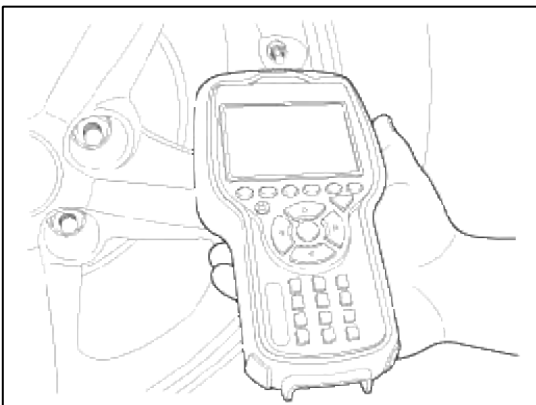
#### CAUTION

Avoid tire / tool contact with the valve.

4. Finish with mounting tool near to valve.
5. Carry out inflation / pressure correction and then fit valve cap.

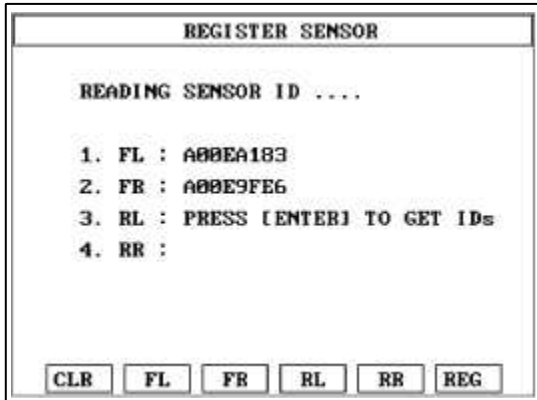
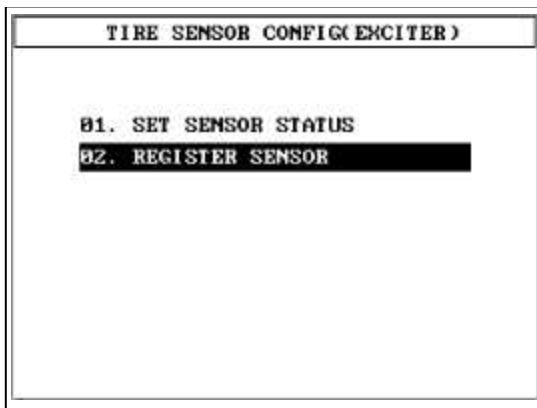
#### Sensor Initiating Procedure

1. Read the four sensor's ids starting with sensor 1 (1 normally front left, 2 front right, 3 rear left, 4 rear right).

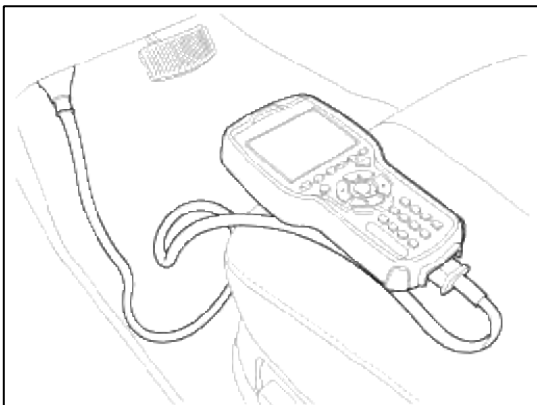


#### NOTE

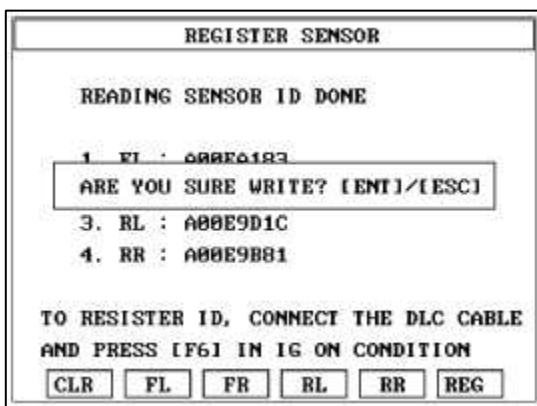
- It is possible to avoid registering each sensor by reading back the learned sensor list and only registering the new sensor in the missing sensor position (if there is a missing position).
- The handheld test tool will automatically check to see whether the receiver is High or Low Line.
- It will then automatically configure sensors accordingly and write their ID's to the receiver memory.
- Note that sensors which were already configured as Base (Low Line) will take longer to read.

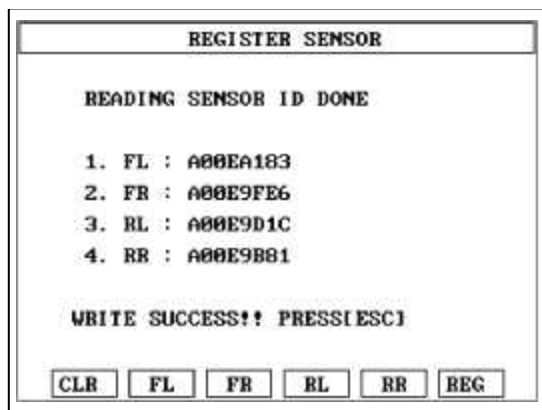


2. Connect 'TPMS exciter' to the diagnostic connector.



3. Register the four sensor's ids to the receiver.

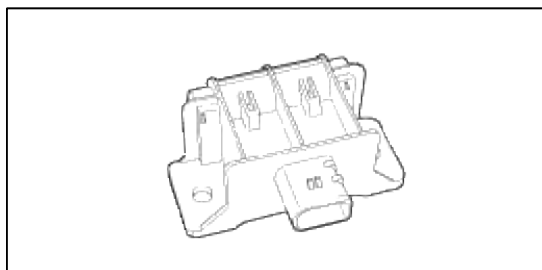




4. Disconnect diagnostic link.
5. Cycle Ignition, wait 3 minutes and check that Normal Receiver State is now indicated.
6. Let each road tire down and check that the system turns the TREAD lamp and correct wheel location LED on accordingly (wait up to 3 minutes). If it does not, then turn wheel a quarter turn and re-check.
7. In the case that re-check does not work, use the handheld tool to check that the correct ID has been registered for each wheel.

## Suspension System > Tire Pressure Monitoring System > TPMS Initiator > Description and Operation

### DESCRIPTION



Initiators are used to radiate magnetic energy to the wheel sensors. The wheel initiators are used to communicate with the TPM wheel sensors. The wheel initiators receive a low energy control signal from the receiver. This signal is amplified and radiated as magnetic energy to initiate RF response from a wheel sensor.

#### 1. Overview

- A. Only High Line systems are fitted with an LFI.
- B. The LFI is located in the wheel well of each tire, to enable the receiver to determine the vehicle position of each TPMS sensor for which it has a stored TPMS sensor ID code.
- C. When first turned on, the receiver activates the LFI's to wake up the TPMS sensors and get wheel status.
- D. The LFI's are activated every 10 minutes to keep the TPMS sensors awake while the key is on.

#### 2. Operating mode

- A. When triggered by the receiver the LFI broadcasts a 125 KHz signal through the tire to the TPMS sensors to wake them up.
- B. After broadcasting the LFI returns to sleep mode until triggered again by the receiver.
- C. Once the TPMS sensor has received the 125 KHz wake up signal, it broadcasts its ID and status. This information plus which LFI triggered it allows the receiver to record which tire has which sensor.

### OPERATION

#### 1. Type 1 learn mode

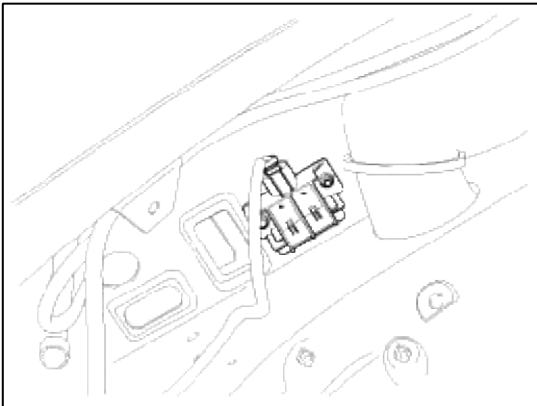
- A. TPMS sensor learning via K-line diagnostic bus using TPMS Exciter.

2. Type 2 learn mode
  - A. Learn via LFI wand
  - B. Enter type 2 learn mode via K-line command.
  - C. Trigger each TPMS sensor in the following order FL, FR, RL, and RR with the LFI wand.
  - D. Exit type II learn mode.
3. Type 3 learn mode (High line only)
  - A. Enter type 3 learn mode via K-line command.
  - B. Receiver triggers each LFI and programs TPMS sensors and received.

#### **Suspension System > Tire Pressure Monitoring System > TPMS Initiator > Repair procedures**

##### **REPLACEMENT**

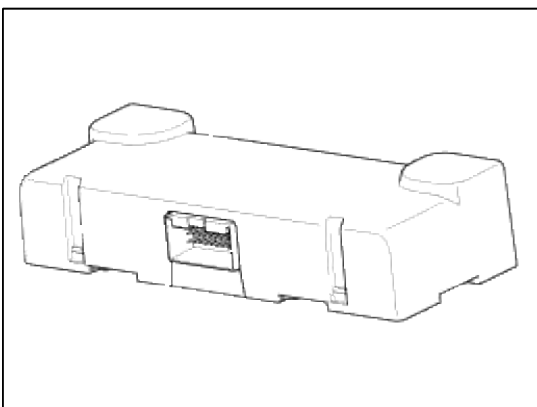
1. Disconnect vehicle battery.
2. Remove the malfunctioning part and fit new part.



3. Secure new part to vehicle and fit connector.
4. Re-connect the battery and turn ignition on.

#### **Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Description and Operation**

##### **DESCRIPTION**

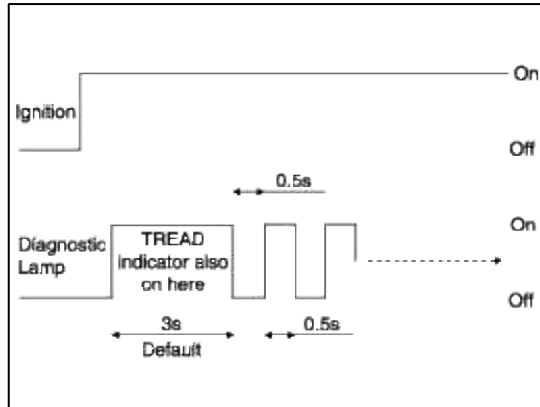




## 1. Mode

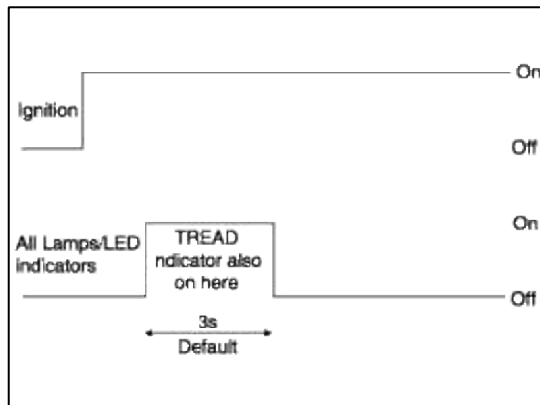
### (1) Virgin State

- A. The receiver as a sole part is shipped in this state. Replacement parts should therefore arrive in this state.
- B. In this state, there is no Auto-Location, no sensor wake-up, no sensor monitoring and no DTC monitoring..
- C. The state indicates that platform specific parameters must be written to the receiver and that sensors are un-learned.



### (2) Normal State

- A. In order for tire inflation state and DTC monitoring to occur, the receiver must be in this state.
- B. In this state, automatic sensor location / learning is enabled.



## 2. Overview

- A. Sends LF command data to initiators.
- B. Controls sensor state:
  - Ignition on - Normal Delayed
  - Ignition off - Storage.
- C. Auto-Locates sensors.
- D. Auto-Learns new sensors.
- E. Receives RF data from sensor.
- F. Uses sensor data to decide whether to turn on TREAD Lamp / wheel location LED's.
- G. Uses sensor information, distance traveled, background noise levels, Auto-learn status, short circuit output status, vehicle battery level, internal receiver states to determine if there is a system or a vehicle fault.

## OPERATION

## 1. General Function

- A. Auto-locate/learn takes place only once per Ignition cycle.
- B. On successful completion, 4 road wheel sensor ID's + 1 spare, together with their respective road wheel positions are latched into memory for monitoring.
- C. Until Auto-learn completes, previously learned sensors (together with their respective locations) are monitored for under inflation / leak warnings.
- D. Spare tire inflation / DTC state is not displayed.
- E. Spare tire DTC's are available through diagnostics only.

## 2. General Conditions to Learn New Sensors:

- A. Receiver must Auto-Locate 4 road sensors.
- B. Auto-location / learning only functions when speed is more than 20 kph (approx. 15 mph).
- C. Receiver must determine that it is confident that sensor is not temporary:
  - 1) Uses vehicle speed.
  - 2) Uses confidence reduction of previously learned sensors.
- D. Typical time at driving over 20 kph to learn a new sensor is up to 10 minutes.

## 3. General Conditions to Un-Learn a sensor that is removed:

- A. It takes less than 10 minutes at 20~30kph.
- B. Confidence reduction is dependant on vehicle speed and the number of sensors known to the receiver.

# Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Repair procedures

## REPLACEMENT

### NOTE

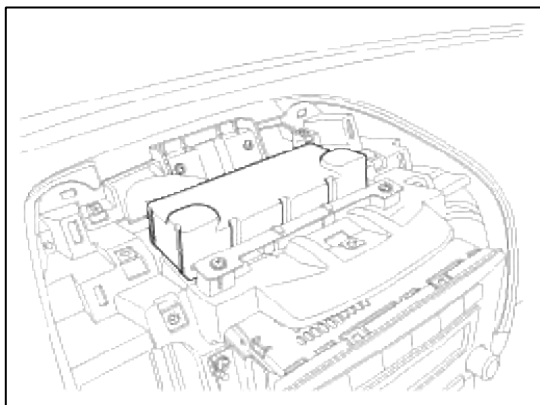
When the receiver first arrives for replacement:

- 1) It will be in Virgin State.
- 2) It will not be configured for any specific platform.
- 3) It will not have any sensor ID's memorized.

### CAUTION

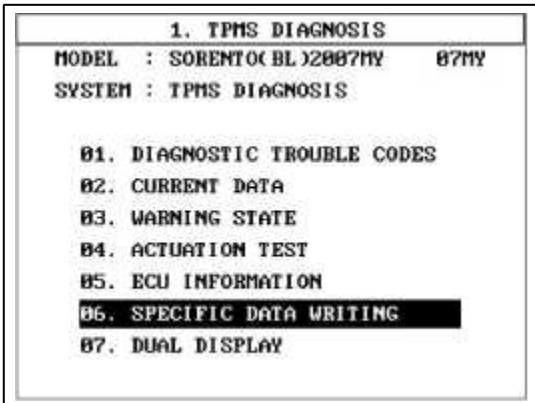
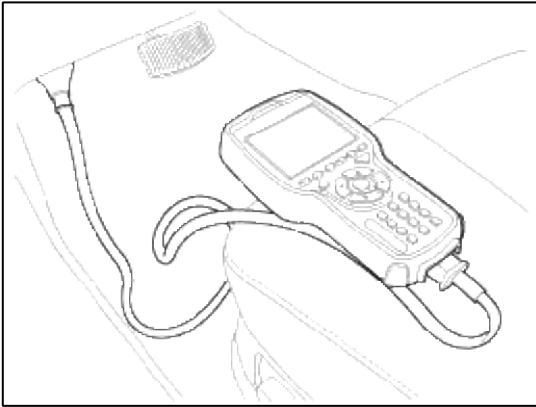
It is important to make sure that the correct receiver is used to replace the faulty part i.e. it must be Low Line (PN 95800-2E500) and not High Line (PN 95800-26000) in order to have the correct inflation warning thresholds set.

- 1. Disconnect vehicle battery.
- 2. Remove faulty part and fit bracket assembly to new part.

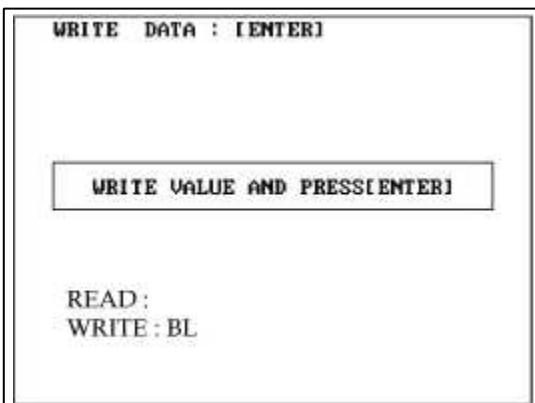


- 3. Secure new part to vehicle and fit connector.
- 4. Re-connect battery and turn Ignition on.
- 5. Check that DTC flash rate matches Virgin State indication.

6. Connect 'TPMS exciter' to the diagnostic connector.



7. Write vehicle name to receiver. receiver will now automatically update monitoring parameters.



8. Read sensor's IDs with the 'TPMS exciter'.  
(Refer to 'SENSOR INITIATING PROCEDURE')

9. Register sensor's IDs to receiver.

SPECIFIC DATA WRITING	
01. VEHICLE NAME	
02. WHEEL SENSOR ID	
03. VIN	
04. MODE CONFIGURATION	

WHEEL SENSOR ID		
	CURRENT ID	CHANGE ID
SNSR1 [FL]	4FA0009E	4FA0009E
SNSR2 [FR]	69C19100	69C19100
SNSR3 [RL]	00000000	00000000
SNSR4 [RR]	00000000	00000000
SENSOR 5	00000000	00000000

MODIFY SENSOR ID AND PRESS[ENTER]

10. Register VIN number of the vehicle.(17 digits)

SPECIFIC DATA WRITING	
01. VEHICLE NAME	
02. WHEEL SENSOR ID	
03. VIN	
04. MODE CONFIGURATION	

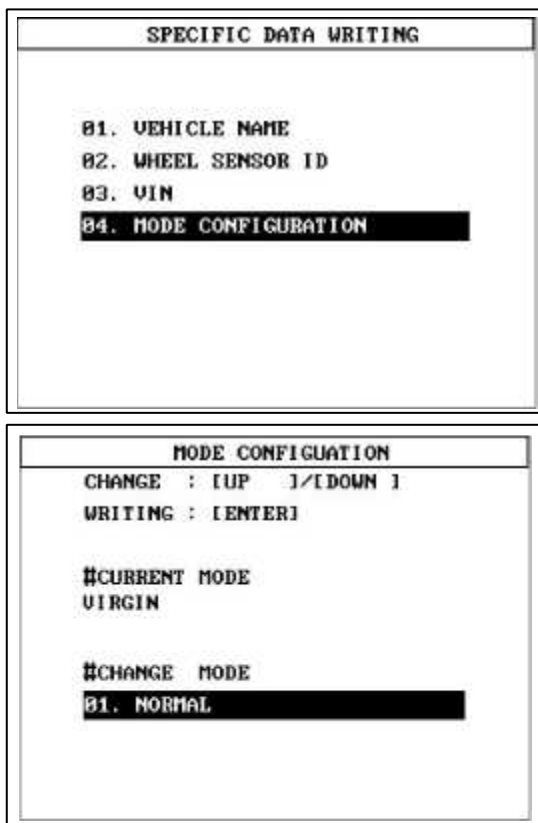
WRITE DATA : [ENTER]

WRITE VALUE AND PRESS[ENTER]

READ :

WRITE: 0000000000000000

11. Change receiver state from Virgin to Normal.



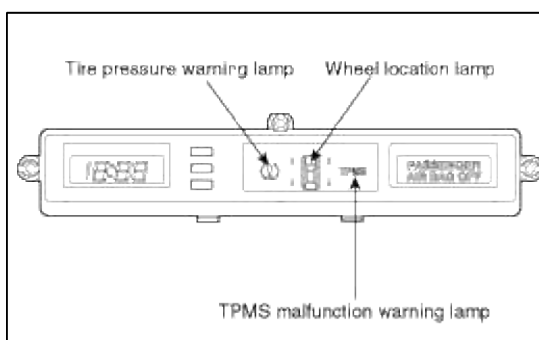
12. Disconnect diagnostic link.

13. Turn ignition off for approximately 10 seconds then turn it back on and check that Normal State is now indicated.

## Suspension System > Tire Pressure Monitoring System > Description and Operation

### DESCRIPTION

#### WARNING LAMPS



#### TREAD Lamp

- Tire Under Inflation / Leak Warning.



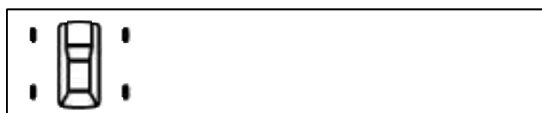
1. Turn on condition

- A. When tire pressure is below allowed threshold
- B. When rapid leak is detected by the sensor.
- C. Indicates that tire needs to be re-inflated to placard pressure / repaired.

2. Turn off condition

- A. Under-inflation ; When tire pressure is above (warning threshold + hysteresis).
- B. Rapid Leak ; When tire pressure is above (leak warning threshold).

## Wheel Location



1. Turn on condition
  - A. At the same time as TREAD Lamp.
  - B. Indicates wheel location where under inflation / leak has occurred.
2. Turn off condition
  - A. At the same time as TREAD Lamp.

### NOTE

If wheel locations change in between Ignition cycles, then the system assumes the previous Auto-Located position. Once Auto-Location completes on the current Ignition cycle, the correct lamp will be lit.

## DTC Warning

### TPMS

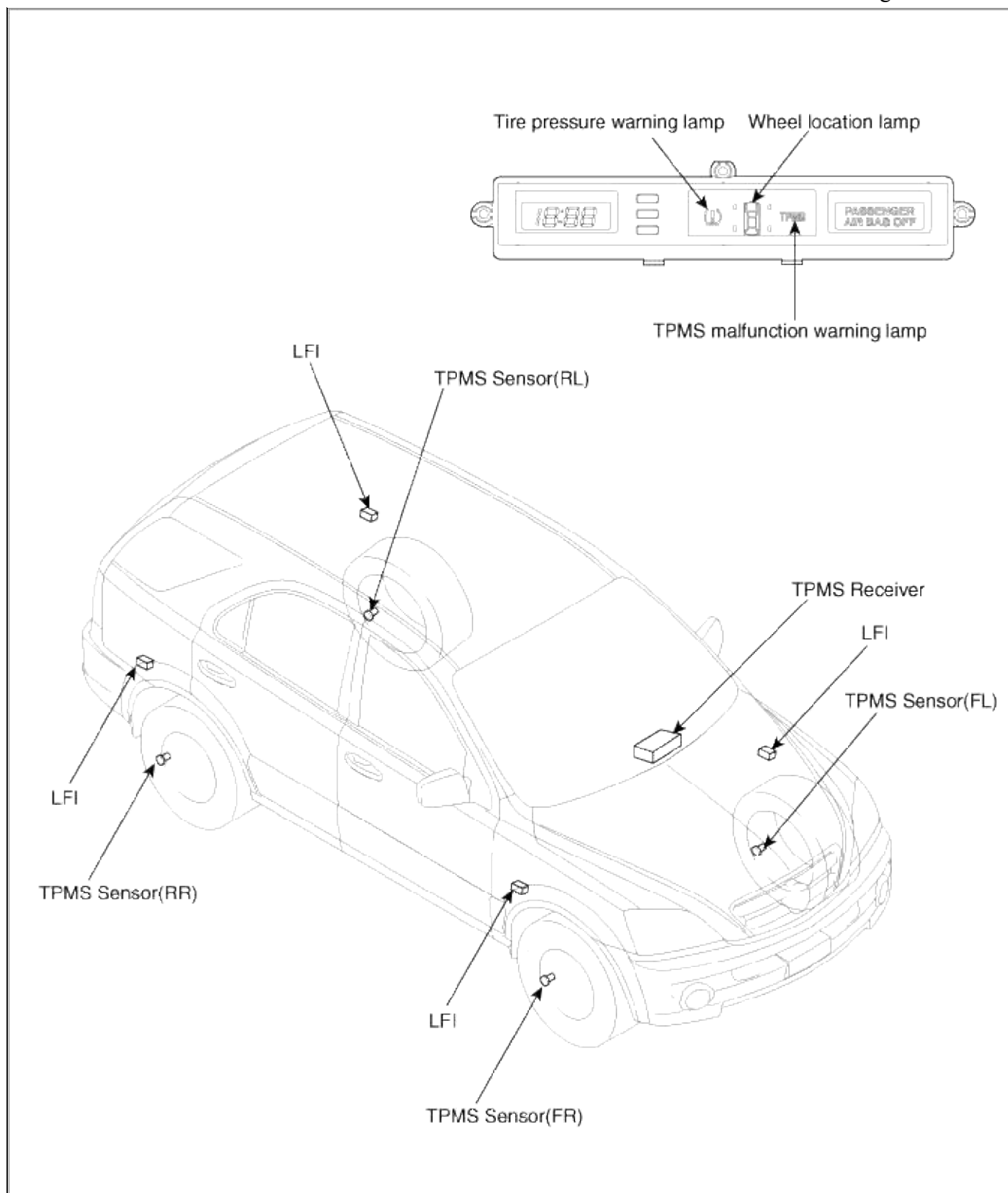
1. Turn on condition
  - A. When the system detects a fault that is external to the receiver / initiator / sensor.
  - B. When the system detects a receiver fault.
  - C. When the system detects an initiator fault.
  - D. When the system detects a sensor fault.
2. Turn off condition
  - A. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
  - B. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

## SYSTEM FAULT

1. General Function
  - A. The system monitors a number of inputs across time in order to determine that a fault exists.
  - B. Faults are prioritized according to which has the most likely cause.
  - C. Maximum fault store is equal to 15.
  - D. Certain faults are not covered through DTC. The main ones are:
    - 1) Speed input. This is important since it is required for Auto-Learn & DTC. Requires diagnostic check of speed while driving vehicle to diagnose.
    - 2) Sensor thermal shutdown (over 257°F/125°C).
    - 3) Receiver Micro-controller lock up ; requires observation of lamps at Ignition ON to diagnose.
    - 4) Ignition Line stuck ; requires observation of lamps at Ignition ON to diagnose.

## Suspension System > Tire Pressure Monitoring System > Components and Components Location

components



### Suspension System > Tire Pressure Monitoring System > Troubleshooting

#### TROUBLESHOOTING

- the lamp check should occur and then all lamps / LED's should turn off.
- **If the lamp test does not occur:**

- Check connectors and fuse/harnessing - open / short circuits.
- Check DTC's.
- If diagnostics cannot be entered, replace the receiver with a known good one (follow configuration & learning procedure).

#### TREAD warnings

##### - Information to ascertain (TREAD Lamp):

- Was puncture repair fluid used (it should not be)?
  - This can cause the sensor pressure port to block and incorrect warning to occur.
- What temperature were tires last inflated at?  
At what temperature did warnings occur?
  - Pressure change is approx. 1.5psi / 10°C increase.
- Have the tires been checked / inflated since the lamp first came on?

##### - If the TREAD Lamp is on:

- Check for short circuits.
- Enter Diagnostics and read TREAD Warnings Local Identifier Data.
- Check to see if warning type is under inflation or leak.
- If the warning is for under inflation, then:
  - a. Re-inflate the wheel with the matching sensor ID to it's desired Placard pressure.
  - b. Check to make sure that the TREAD lamp turns off (this may take up to 1.5 minutes if the tire is not rapidly re-inflated).
- If the warning is for a leak, then:
  - a. Fix any puncture and re-inflate the tire to the desired Placard pressure.
  - b. Wait up to 3 minutes and make sure that the TREAD lamp turns off and the lamp does not turn on again.
  - c. If lamp comes on again:
  - d. Re-check pressure for signs of a puncture and Re-Check TREAD Warnings Local Identifier Data.

##### - If the Placard pressure is OK and the TREAD lamp still does not turn off:

- Turn wheel a quarter turn and again wait 1.5 minutes (the sensor may be in an RF null).
- If the lamp still does not turn off:  
check for loose receiver wiring and replace the receiver with a known good one if necessary (follow configuration & learning procedure).
  - If the problem still exists, replace sensor.
  - Ensure that all tires are inflated to their correct Placard pressures.
  - Clear TREAD warnings.
  - Test drive the vehicle and ensure that the TREAD lamp does not come back on.

#### DTC's

##### - Information to ascertain (DTC Lamp):

- At what temperature did the DTC occur? Under certain conditions (approx. -40°C/F), a RF channel missing / hardware failure DTC may occur. This is due to the battery behavior.
- DTC's should be retrieved by using Hi-Scan diagnostic tool.
- The fault should then be diagnosed and rectified.
- DTC's should then be cleared.

DTC	Warning Type	Trouble Description	Diagnostic Lamp
C1121	Battery Level	Sensor 1 battery Low.	Permanent during
C1122		Sensor 2 battery Low.	
C1123		Sensor 3 battery Low.	
C1124		Sensor 4 battery Low.	



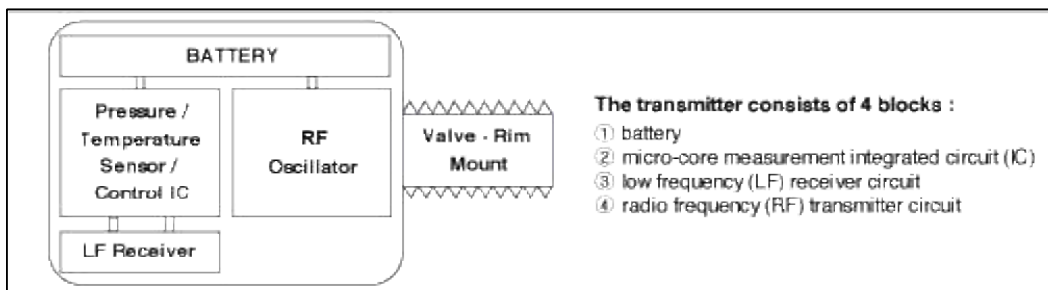
C1126		Vehicle/ TPMS receiver Low.	detection
C1127		Vehicle/ TPMS receiver High.	
C1300	LF/ RF External interference	LF/RF Interference failure	
C1306	RF internal interference	Internal vehicle RF source e.g. scanner.	Permanent
C1312	Individual RF channel failure	Sensor 1/ Front Left RF failure.	Permanent
C1313		Sensor 2/ Front Right RF failure.	
C1314		Sensor 3/ Rear Left RF failure.	
C1315		Sensor 4/ Rear Right RF failure.	
C1322	Sensor over Temperature	Sensor 1/ Front Left Sensor over 230°F(110°C).	Permanent
C1323		Sensor 2/ Front Right Sensor over 230°F(110°C).	
C1324		Sensor 3/ Rear Left Sensor over 230°F(110°C).	
C1325		Sensor 4/ Rear Right Sensor over 230°F(110°C).	
C1332	Sensor Failure	Sensor 1/ Front Left RF Fault.	Permanent
C1333		Sensor 2/ Front Right RF Fault.	
C1334		Sensor 3/ Rear Left RF Fault.	
C1335		Sensor 4/ Rear Right RF Fault.	
C1341	Individual LF channel failure	Front Left LF failure.	Permanent
C1342		Front Right LF Failure.	
C1343		Rear Left LF Failure.	
C1344		Rear Right LF Failure.	
C1660	System Hardware	TPMS receiver RF circuit.	Permanent
C1661	EEPROM Failure	TPMS receiver EEPROM Failure.	Permanent
C1664	System Hardware	Initiator/ LF Circuit/ RF Circuit Failure not affecting RSSI level	Permanent
C1665	Initiator short circuit	Initiator supply short circuit to GRD.	Permanent
C1666		Initiator supply short circuit to 12V.	
C1668	Micro controller error	Repeated Watchdog Reset/ internal failure detection.	Permanent
C2510	Lamp/ LED short Circuit	TREAD Lamp short circuit to 12V.	Permanent
C2511		Diagnostic Lamp short circuit to 12V.	
C2512		Front Left LED short circuit to 12V.	
C2513		Front Right LED short circuit to 12V.	
C2514		Rear Left LED short circuit to 12V.	
C2515		Rear Right LED short circuit to 12V.	

## Suspension System > Troubleshooting > C1121

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims. Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

### DTC Description

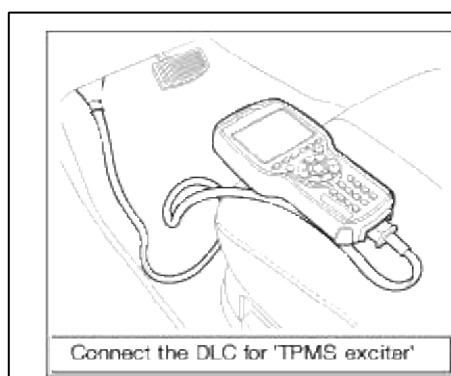
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	<ul style="list-style-type: none"> <li>• Sensor temperature low</li> <li>• Sensor battery low</li> <li>• Faulty TPMS sensor</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• Latest Lowest sensor Temp. &gt; -4 °F(-20 °C)</li> <li>• Distance travelled during 12 min. &gt; 4 km</li> </ul>	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

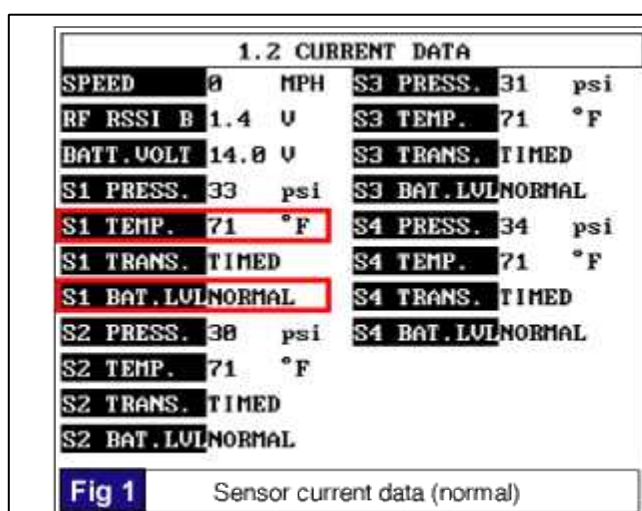
### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F( -20 °C)and 'Sensor battery value' is 'Normal'.



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

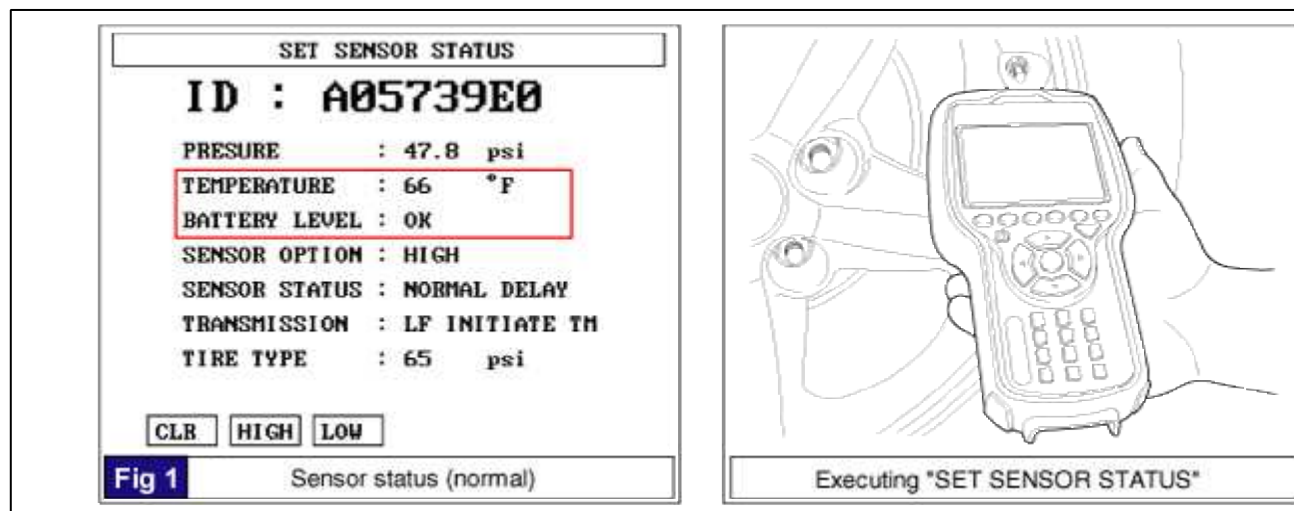
**NO**

Go to "Component Inspection" procedure.

## Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'OK' and 'Sensor Temp.' is more than -68 °F( -20 °C).



4. Is any sensor data outside specification?

**YES**

The sensor which displays data above the specification is SENSOR 1.

Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as follows.

**NO**

Check for sensor if unable to retrieve data with 'TPMS exciter'.

Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

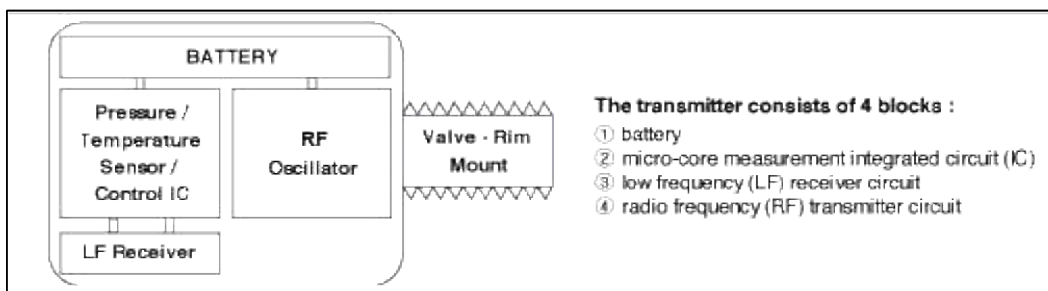
System performing to specification at this time.

## Suspension System > Troubleshooting > C1122

## Component Location



## General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

## DTC Description

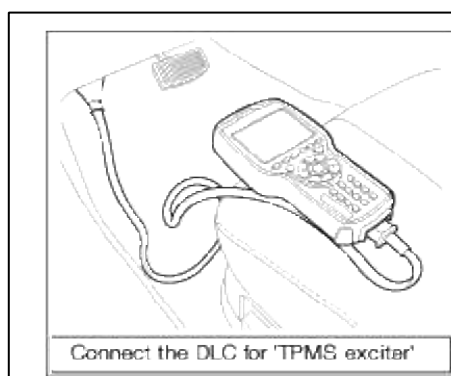
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

## DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	<ul style="list-style-type: none"> <li>• Sensor temperature low</li> <li>• Sensor battery low</li> <li>• Faulty TPMS sensor</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• Latest Lowest sensor Temp. &gt; -4 °F(-20 °C)</li> <li>• Distance travelled during 12 min. &gt; 4 km</li> </ul>	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

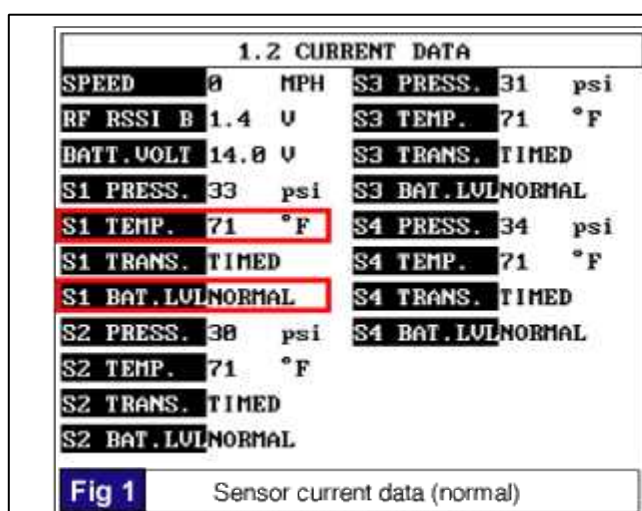
### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F( -20 °C)and 'Sensor battery value' is 'Normal'.



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

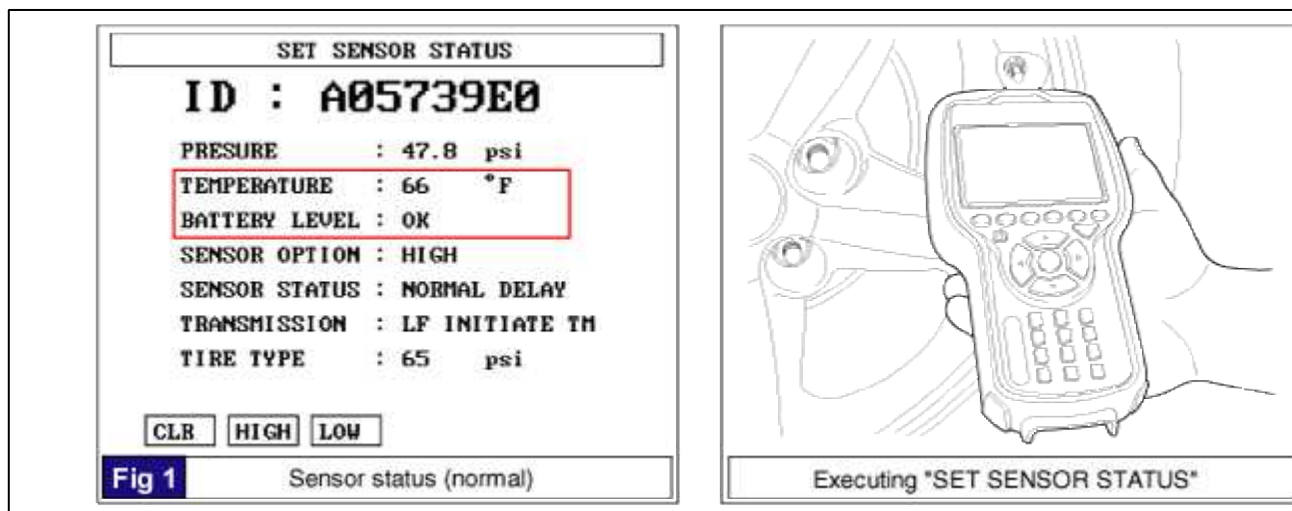
**NO**

Go to "Component Inspection" procedure.

## Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'OK' and 'Sensor Temp.' is more than -68 °F( -20 °C).



4. Is any sensor data outside specification?

**YES**

The sensor which displays data above the specification is SENSOR 1.

Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as follows.

**NO**

Check for sensor if unable to retrieve data with 'TPMS exciter'.

Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

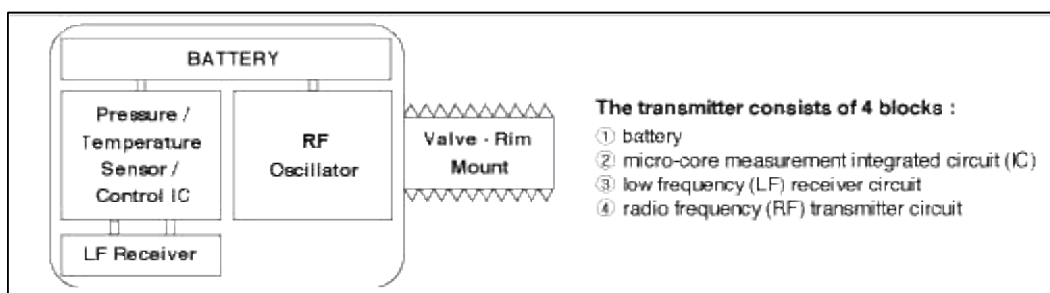
System performing to specification at this time.

## Suspension System > Troubleshooting > C1123

## Component Location



## General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

## DTC Description

This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

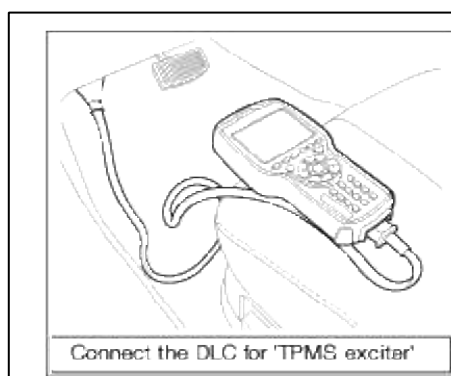
## DTC Detecting Condition



Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	<ul style="list-style-type: none"> <li>• Sensor temperature low</li> <li>• Sensor battery low</li> <li>• Faulty TPMS sensor</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• Latest Lowest sensor Temp. &gt; -4 °F(-20 °C)</li> <li>• Distance travelled during 12 min. &gt; 4 km</li> </ul>	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

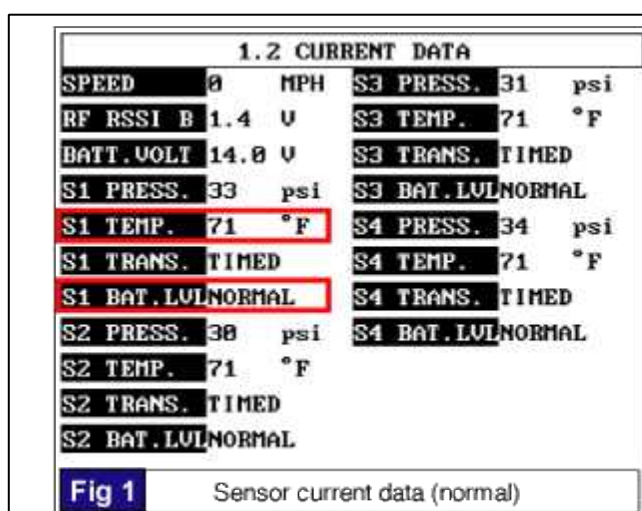
### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F( -20 °C)and 'Sensor battery value' is 'Normal'.



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

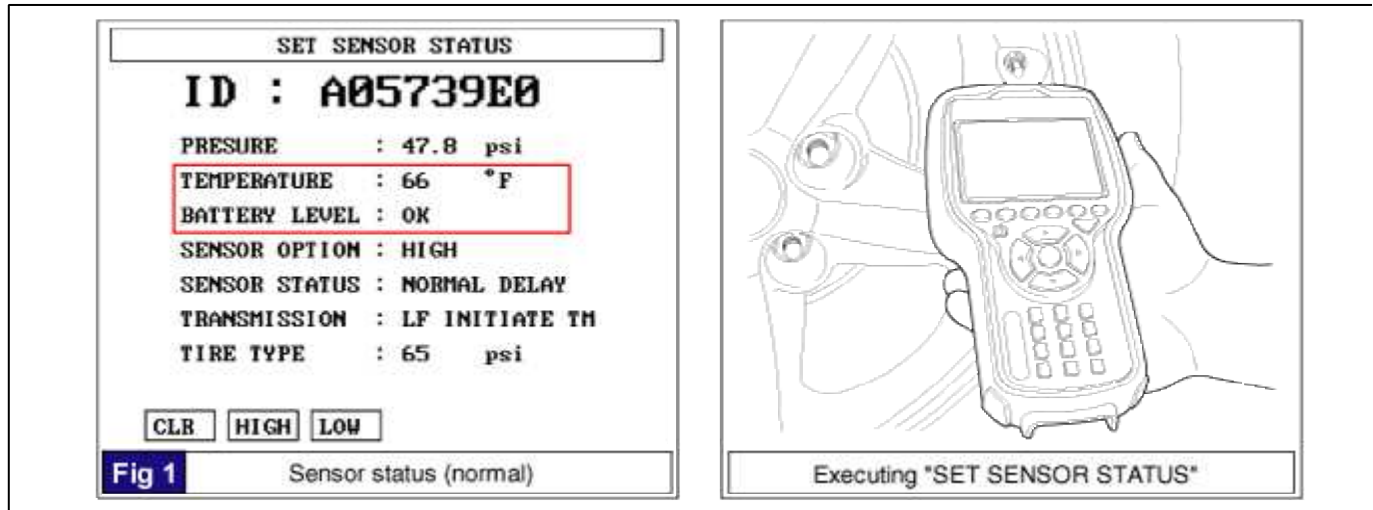
**NO**

Go to "Component Inspection" procedure.

## Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'OK' and 'Sensor Temp.' is more than -68 °F( -20 °C).



4. Is any sensor data outside specification?

**YES**

The sensor which displays data above the specification is SENSOR 1.

Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as follows.

**NO**

Check for sensor if unable to retrieve data with 'TPMS exciter'.

Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

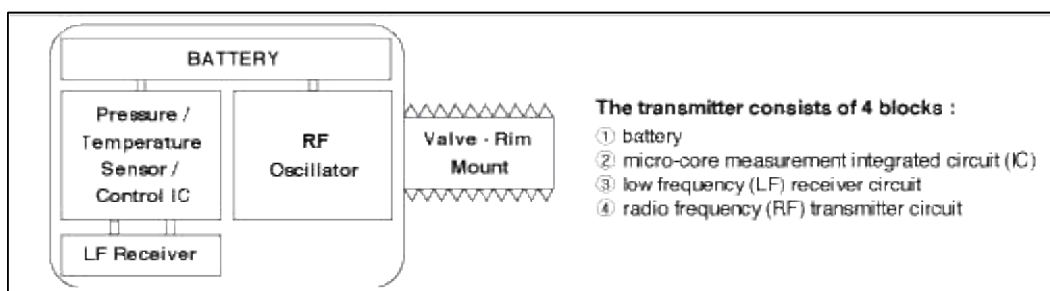
System performing to specification at this time.

## Suspension System > Troubleshooting > C1124

## Component Location



## General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

## DTC Description

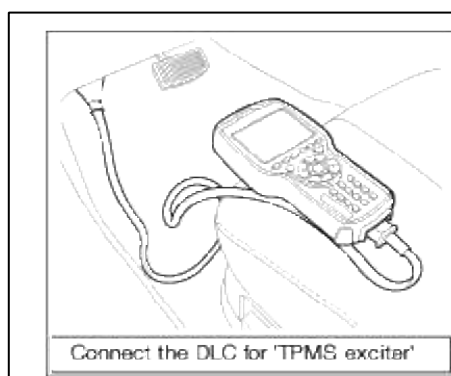
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

## DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	<ul style="list-style-type: none"> <li>• Sensor temperature low</li> <li>• Sensor battery low</li> <li>• Faulty TPMS sensor</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• Latest Lowest sensor Temp. &gt; -4 °F(-20 °C)</li> <li>• Distance travelled during 12 min. &gt; 4 km</li> </ul>	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

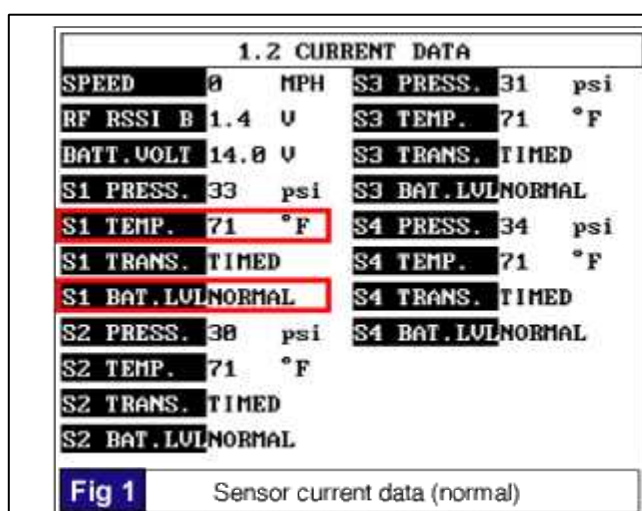
### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F( -20 °C)and 'Sensor battery value' is 'Normal'.



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

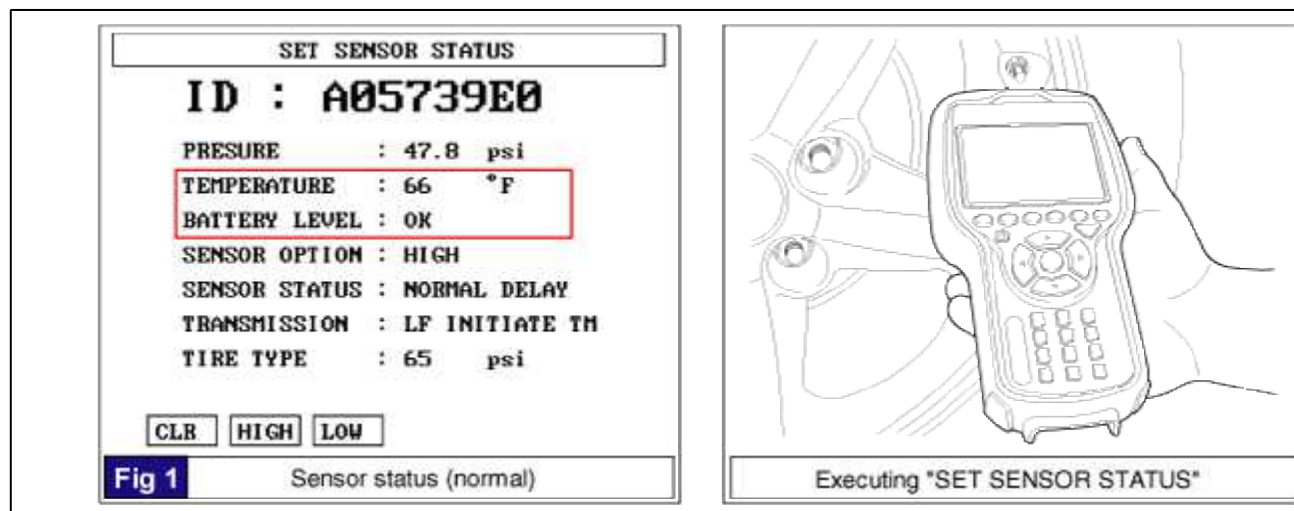
**NO**

Go to "Component Inspection" procedure.

## Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'OK' and 'Sensor Temp.' is more than -68 °F( -20 °C).



4. Is any sensor data outside specification?

**YES**

The sensor which displays data above the specification is SENSOR 1.

Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as follows.

**NO**

Check for sensor if unable to retrieve data with 'TPMS exciter'.

Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

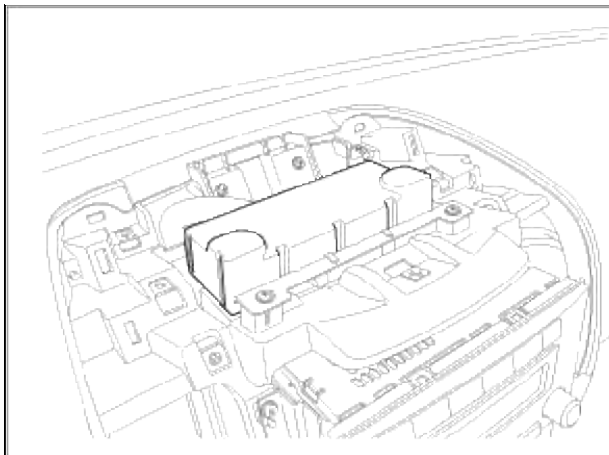
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1126

## Component Location



### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

### DTC Description

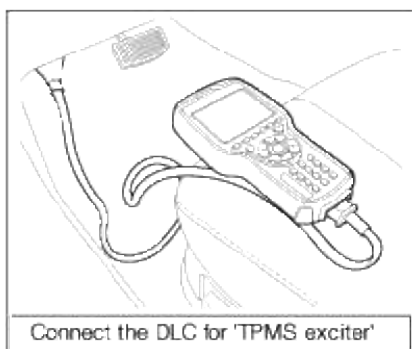
This indicates that the receiver battery level is Low. The most likely cause is battery / harness / receiver input / A-D failure.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Battery level check	<ul style="list-style-type: none"> <li>• Faulty charging system</li> <li>• Vehicle battery low</li> <li>• Faulty TPMS Receiver</li> </ul>
Enable conditions	• Battery voltage level low	
Threshold value	• Battery voltage < 10V	
Diagnosis time	• 2 sec.	

### Monitor Scantool Data

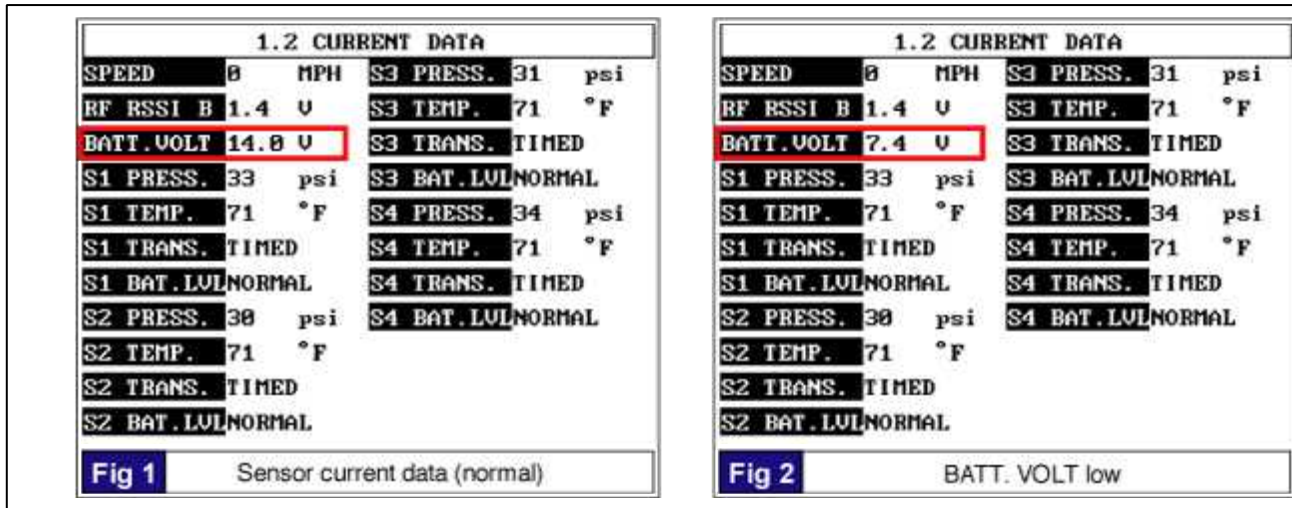
1. Start engine and turn headlight and rear defroster.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.
6. Monitor the parameter of BATT. VOLT on the 'TPMS exciter' or scantool

Specification : 'BATT. VOLT' is more than 10 V



7. Is parameter normal?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Inspection/Repair" procedure.

#### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Charging System Inspection" procedure.

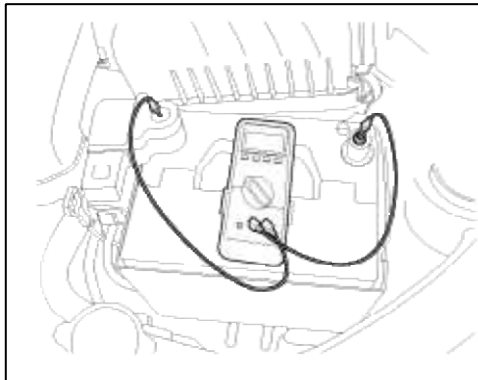
#### Charging System Inspection

1. Engine "ON".
2. headlight and rear defroster "ON".



3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500 RPM(idle) over 2 minutes.

Specification : more than 10 V



4. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPM receiver and check for proper operation.

If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for fault in charging system and check for tension of generator drive belt, ENG.idle rpm or open/short in harness from battery to generator.

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

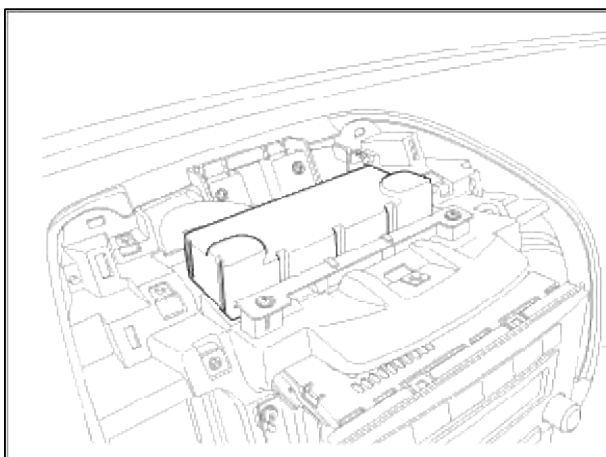
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Suspension System > Troubleshooting > C1127

#### Component Location





### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

### DTC Description

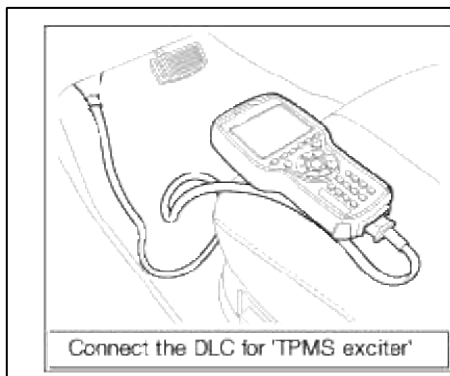
This indicates that the receiver battery level is High. The most likely cause is receiver input / A-D failure.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Battery level check	<ul style="list-style-type: none"> <li>• Faulty charging system</li> <li>• Vehicle battery high</li> <li>• Faulty TPMS Receiver</li> </ul>
Enable conditions	• Battery voltage level high	
Threshold value	• Battery voltage > 17.5 V	
Diagnosis time	• 2 sec.	

### Monitor Scantool Data

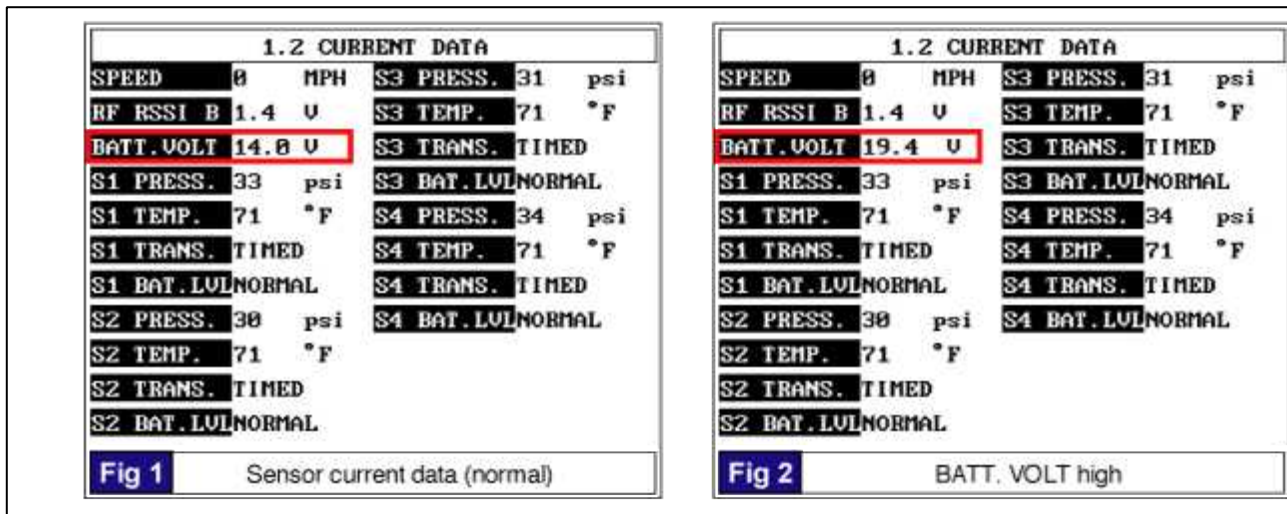
1. Start engine and turn headlight and heatwire on.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

6. Monitor the parameter of BATT. VOLT on the 'TPMS exciter' or scantool.

Specification : 'BATT. VOLT' is less than 16.5 V



7. Is parameter normal?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Inspection/Repair" procedure.

#### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

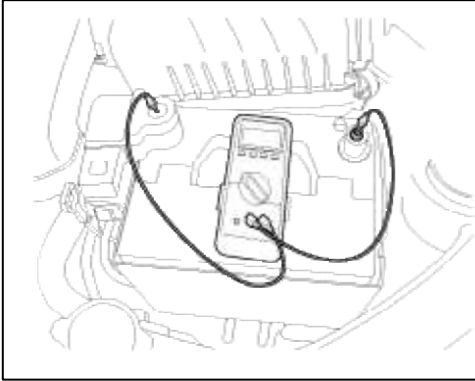
Go to "Charging System Inspection" procedure.

#### Charging System Inspection

1. Engine "ON".
2. headlight and rear defroster "ON".

3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500 RPM(idle) over 2 minutes.

Specification : less than 16.5 V



4. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPM receiver and check for proper operation.

If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for fault in charging system and thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.

Repair or replace if necessary and then go to "Verification of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

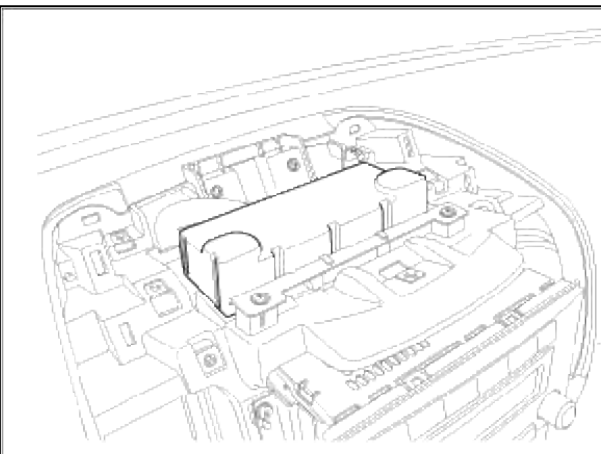
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Suspension System > Troubleshooting > C1300

#### Component Location



### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

### DTC Description

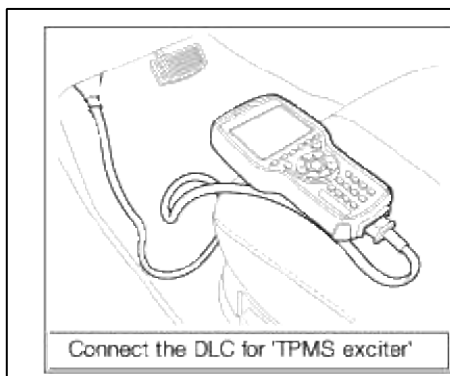
This DTC indicates that system is not functioning due to High interference levels from external sources.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>• LF/RF check</li> </ul>	<ul style="list-style-type: none"> <li>• LF/RF Interference from external sources(unless C1306 also exists as historic. If this is the case then interference source is likely to be internal to the vehicle)</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• System not functioning due to High RF interference levels</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• No valid RF data for 8 min from any sensor</li> <li>• Distance travelled during 8 minutes <math>\leq</math> 1.68 mile(2.7 km)</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>• 8 - 9 minutes</li> </ul>	

### Monitor Scantool Data

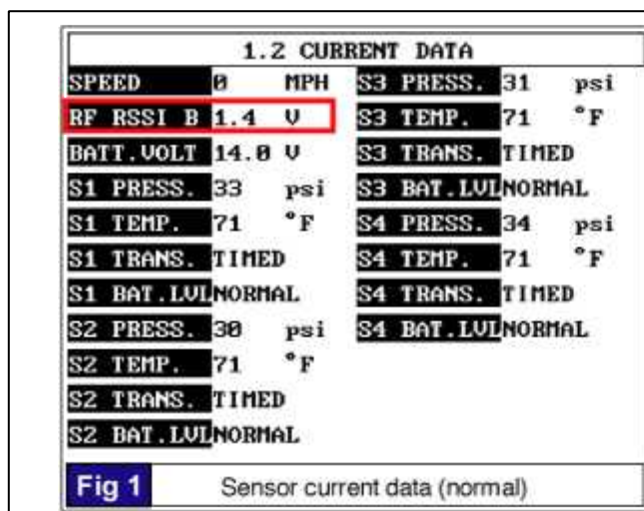
1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor the parameter of RF RSSI background on the 'TPMS exciter' or scantool after 9 minutes.

Specification : "RSSI background" is less than 1.9 V



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.  
If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

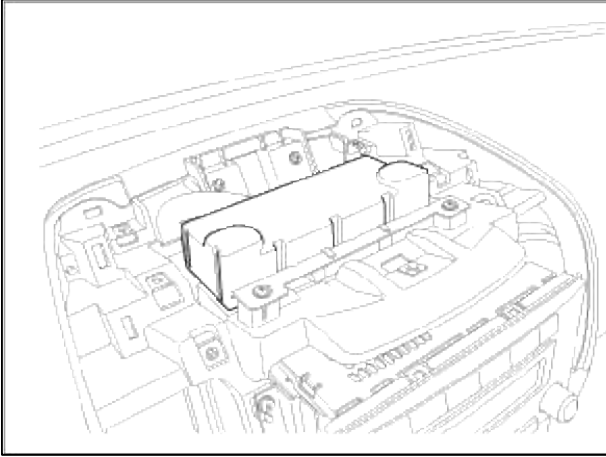
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Suspension System > Troubleshooting > C1306

#### Component Location



### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

### DTC Description

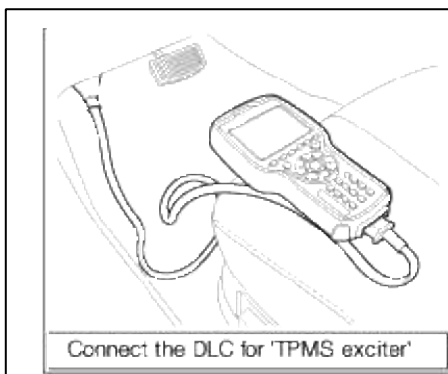
This DTC indicates that system is not functioning due to High interference levels, which are most likely being generated in the vehicle.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• LF/RF check	• Internal vehicle noise source
Enable conditions	• System not functioning due to High RF interference (Internal) levels	
Threshold value	• No valid RF data for 8 min from any sensor • Distance travelled during 8 minutes > 1.68 mile(2.7 km)	
Diagnosis time	• 8 - 9 minutes	

### Monitor Scantool Data

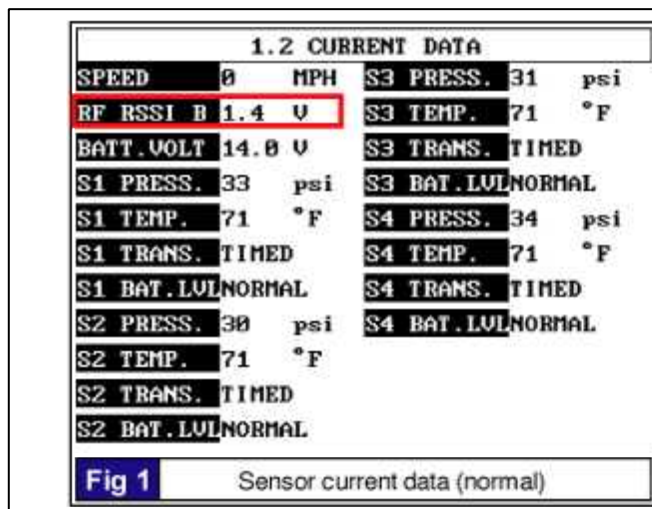
1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.

4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of RF RSSI background on the 'TPMS exciter' or scantool after 9 minutes..

Specification : "RSSI background" is less than 1.9V



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.  
If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

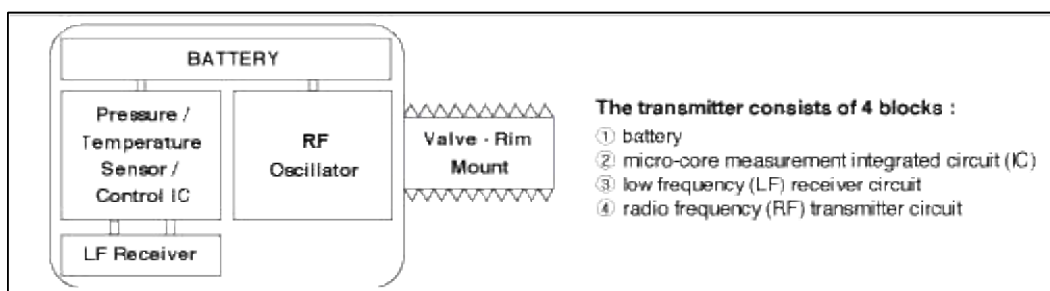
System performing to specification at this time.

## Suspension System > Troubleshooting > C1312

### Component Location



## General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120 °C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

## DTC Description

This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

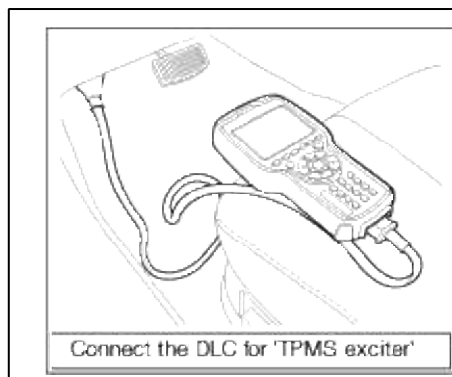
## DTC Detecting Condition



Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>• RF message from sensor1 check</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty TPMS sensor</li> <li>• Incorrectly configured TPMS sensor e.g.Low Line vehicle with High Line sensors.</li> <li>• Low Line vehicle sensors in storage state.</li> <li>• Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle.</li> <li>• Shielding in vehicle.</li> <li>• Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance.</li> <li>• Incorrectly fitted sensor / receiver.</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• 2.48 mile &lt; Distance travelled during 12 min. &lt; 24.85 mile</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Failure to Learn Sensors1 Correctly.</li> <li>• No RF message received from sensor1 over 12 min.</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>• 12 ~ 20 minutes.</li> </ul>	

#### Monitor Scantool Data

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.

4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	33	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	71	°F	S4 PRESS.	34	psi
S1 TRANS.	TIMED		S4 TEMP.	71	°F
S1 BAT.LVL	NORMAL		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	----	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	----	°F	S4 PRESS.	34	psi
S1 TRANS.	UNKNOWN		S4 TEMP.	71	°F
S1 BAT.LVL	UNKNOWN		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 2** Sensor current data (failure)

5. Is parameter normal?

**YES**

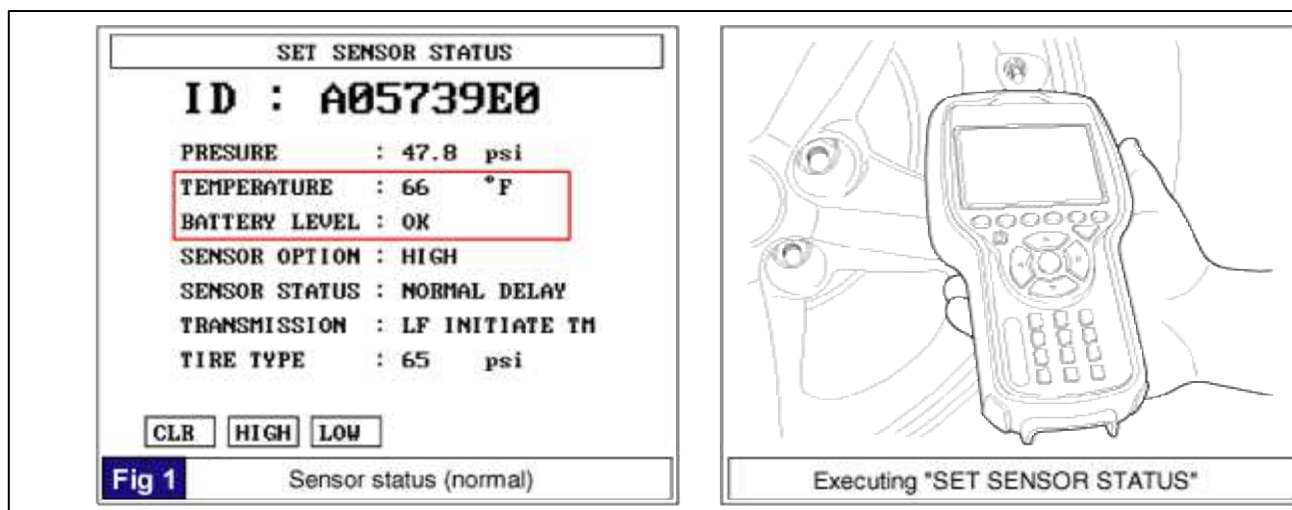
Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.



4. Is data unable to be retrieved for any sensor?

**YES**

Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.

If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

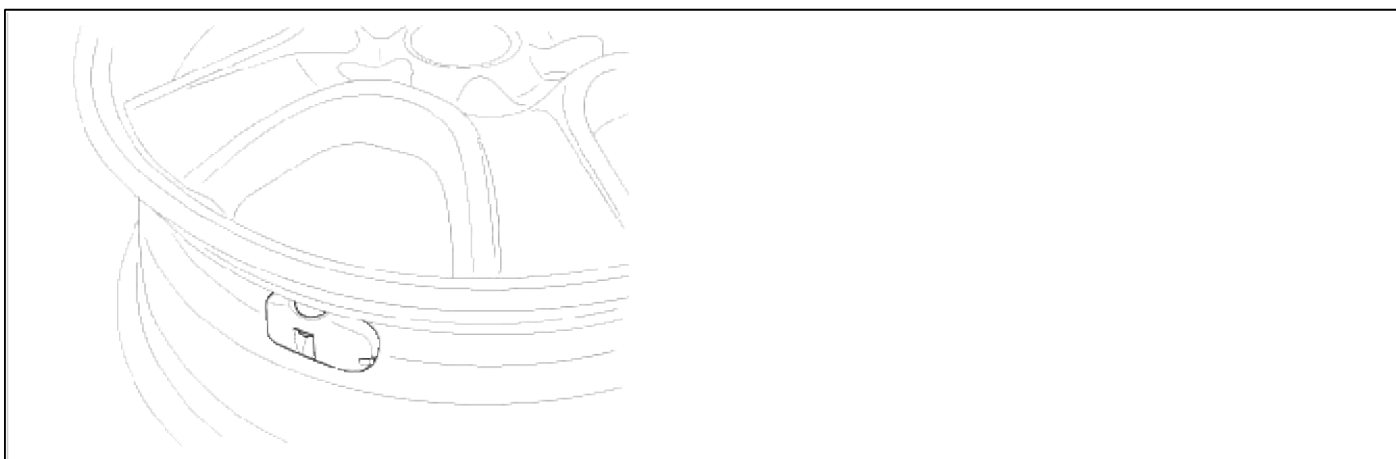
Go to the applicable troubleshooting procedure.

**NO**

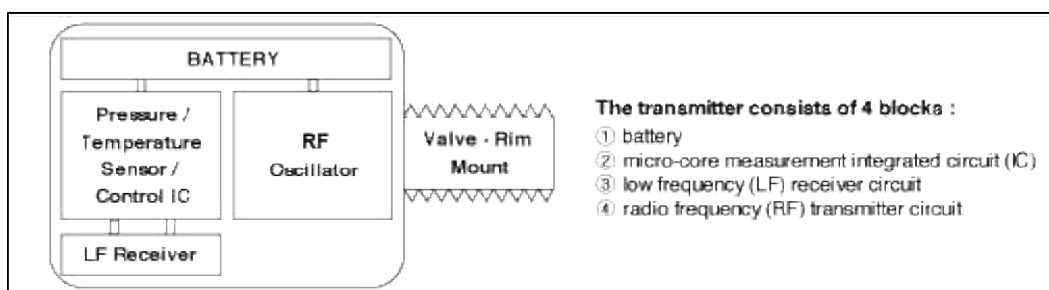
System performing to specification at this time.

## Suspension System > Troubleshooting > C1313

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the

same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

### DTC Description

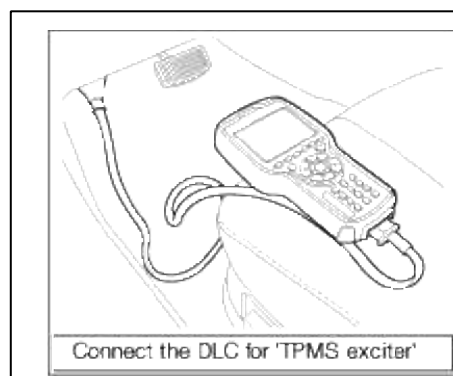
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>• RF message from sensor1 check</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty TPMS sensor</li> <li>• Incorrectly configured TPMS sensor e.g. Low Line vehicle with High Line sensors.</li> <li>• Low Line vehicle sensors in storage state.</li> <li>• Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle.</li> <li>• Shielding in vehicle.</li> <li>• Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance.</li> <li>• Incorrectly fitted sensor / receiver.</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• 2.48 mile &lt; Distance travelled during 12 min. &lt; 24.85 mile</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Failure to Learn Sensors1 Correctly.</li> <li>• No RF message received from sensor1 over 12 min.</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>• 12 ~ 20 minutes.</li> </ul>	

### Monitor Scantool Data

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Select "TPMS DIAGNOSIS" mode.

3. Select the "FULL" mode of "CURRENT DATA" function.

4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	33	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	71	°F	S4 PRESS.	34	psi
S1 TRANS.	TIMED		S4 TEMP.	71	°F
S1 BAT.LVL	NORMAL		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	----	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	----	°F	S4 PRESS.	34	psi
S1 TRANS.	UNKNOWN		S4 TEMP.	71	°F
S1 BAT.LVL	UNKNOWN		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 2** Sensor current data (failure)

5. Is parameter normal?

**YES**

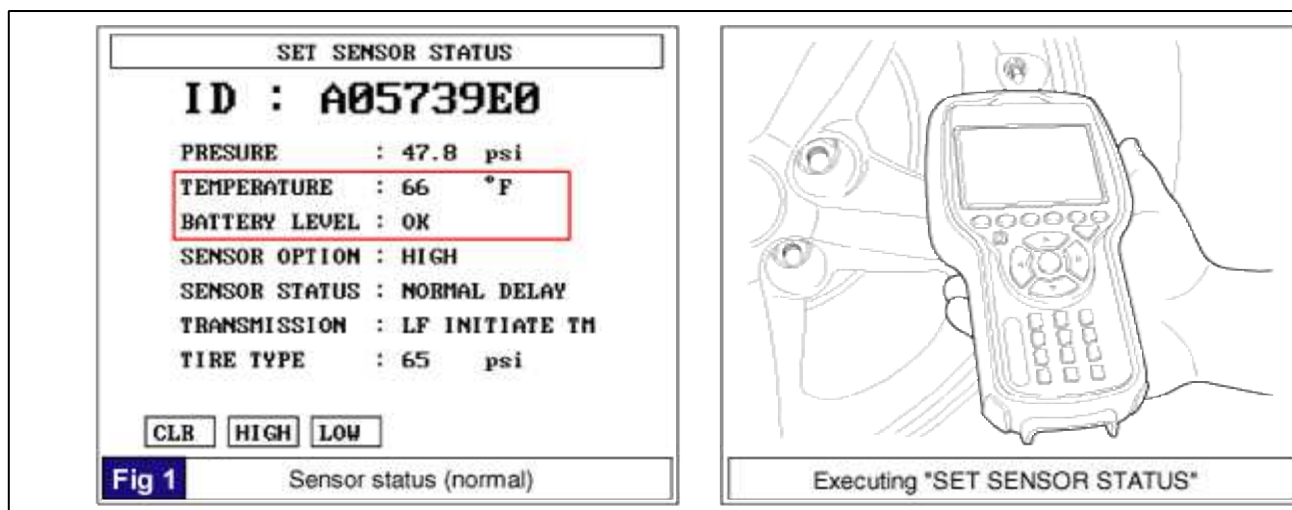
Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.



4. Is data unable to be retrieved for any sensor?

**YES**

Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.

If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

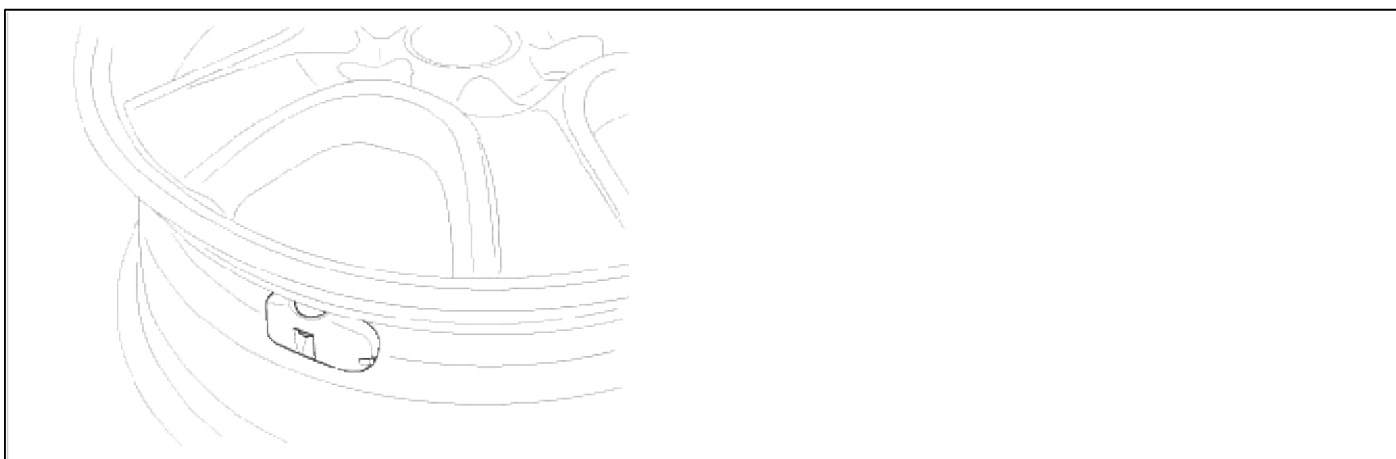
Go to the applicable troubleshooting procedure.

**NO**

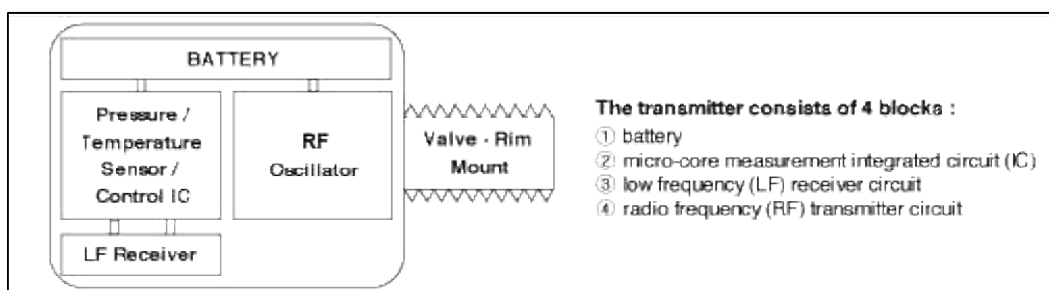
System performing to specification at this time.

## Suspension System > Troubleshooting > C1314

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the

same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

### DTC Description

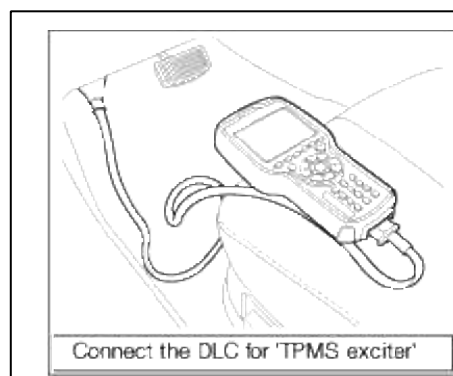
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>RF message from sensor1 check</li> </ul>	<ul style="list-style-type: none"> <li>Faulty TPMS sensor</li> <li>Incorrectly configured TPMS sensor e.g. Low Line vehicle with High Line sensors.</li> <li>Low Line vehicle sensors in storage state.</li> <li>Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle.</li> <li>Shielding in vehicle.</li> <li>Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance.</li> <li>Incorrectly fitted sensor / receiver.</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>2.48 mile &lt; Distance travelled during 12 min. &lt; 24.85 mile</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Failure to Learn Sensors1 Correctly.</li> <li>No RF message received from sensor1 over 12 min.</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>12 ~ 20 minutes.</li> </ul>	

### Monitor Scantool Data

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Select "TPMS DIAGNOSIS" mode.

3. Select the "FULL" mode of "CURRENT DATA" function.



4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	33	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	71	°F	S4 PRESS.	34	psi
S1 TRANS.	TIMED		S4 TEMP.	71	°F
S1 BAT.LVL	NORMAL		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	----	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	----	°F	S4 PRESS.	34	psi
S1 TRANS.	UNKNOWN		S4 TEMP.	71	°F
S1 BAT.LVL	UNKNOWN		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 2** Sensor current data (failure)

5. Is parameter normal?

**YES**

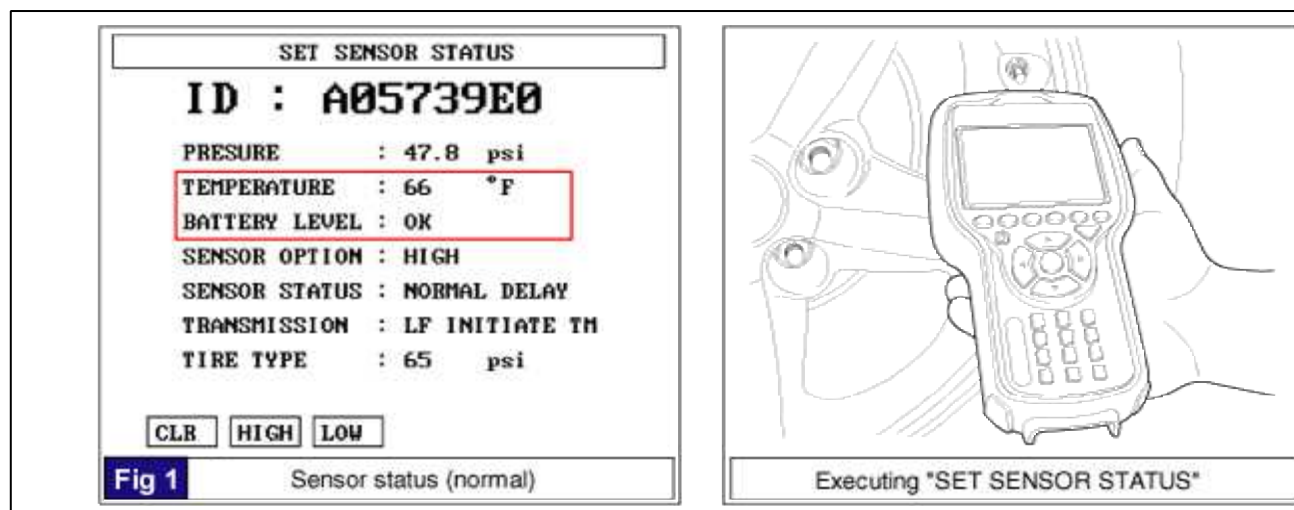
Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.



4. Is data unable to be retrieved for any sensor?

**YES**

Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.  
If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.



1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

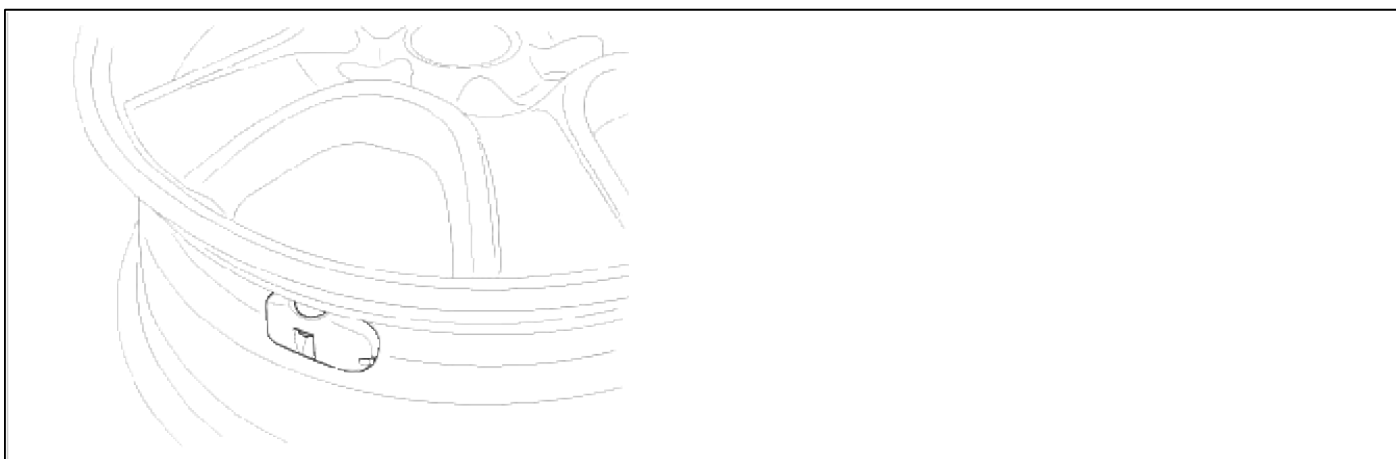
Go to the applicable troubleshooting procedure.

**NO**

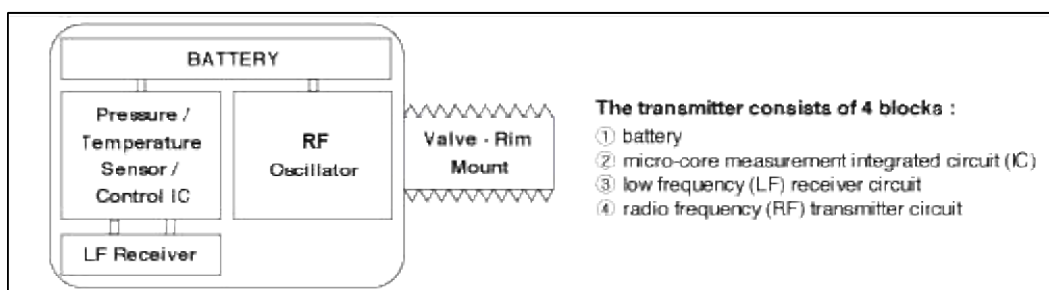
System performing to specification at this time.

## Suspension System > Troubleshooting > C1315

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the

same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

### DTC Description

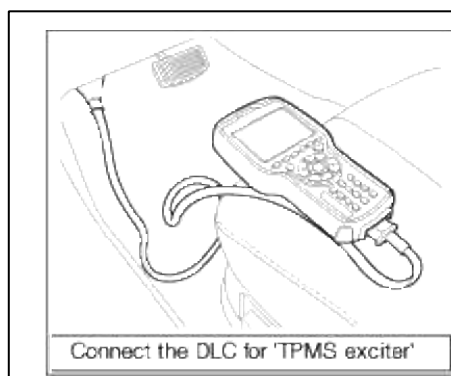
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>• RF message from sensor1 check</li> </ul>	<ul style="list-style-type: none"> <li>• Faulty TPMS sensor</li> <li>• Incorrectly configured TPMS sensor e.g. Low Line vehicle with High Line sensors.</li> <li>• Low Line vehicle sensors in storage state.</li> <li>• Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle.</li> <li>• Shielding in vehicle.</li> <li>• Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance.</li> <li>• Incorrectly fitted sensor / receiver.</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• 2.48 mile &lt; Distance travelled during 12 min. &lt; 24.85 mile</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• Failure to Learn Sensors1 Correctly.</li> <li>• No RF message received from sensor1 over 12 min.</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>• 12 ~ 20 minutes.</li> </ul>	

### Monitor Scantool Data

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Select "TPMS DIAGNOSIS" mode.

3. Select the "FULL" mode of "CURRENT DATA" function.

4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	33	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	71	°F	S4 PRESS.	34	psi
S1 TRANS.	TIMED		S4 TEMP.	71	°F
S1 BAT.LVL	NORMAL		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	----	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	----	°F	S4 PRESS.	34	psi
S1 TRANS.	UNKNOWN		S4 TEMP.	71	°F
S1 BAT.LVL	UNKNOWN		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 2** Sensor current data (failure)

5. Is parameter normal?

**YES**

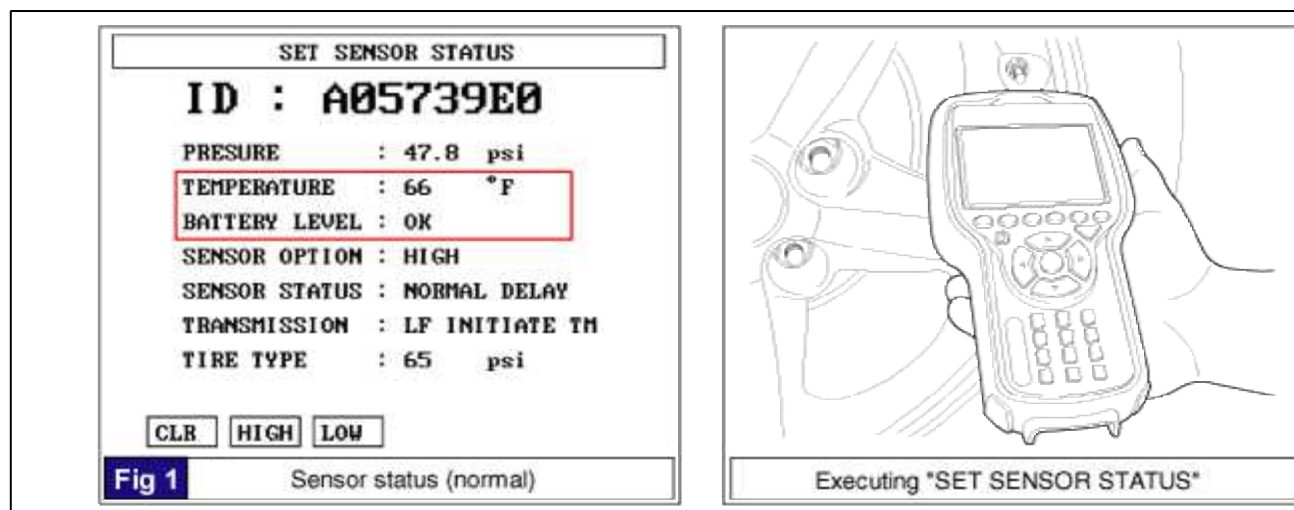
Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.



4. Is data unable to be retrieved for any sensor?

**YES**

Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.

If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

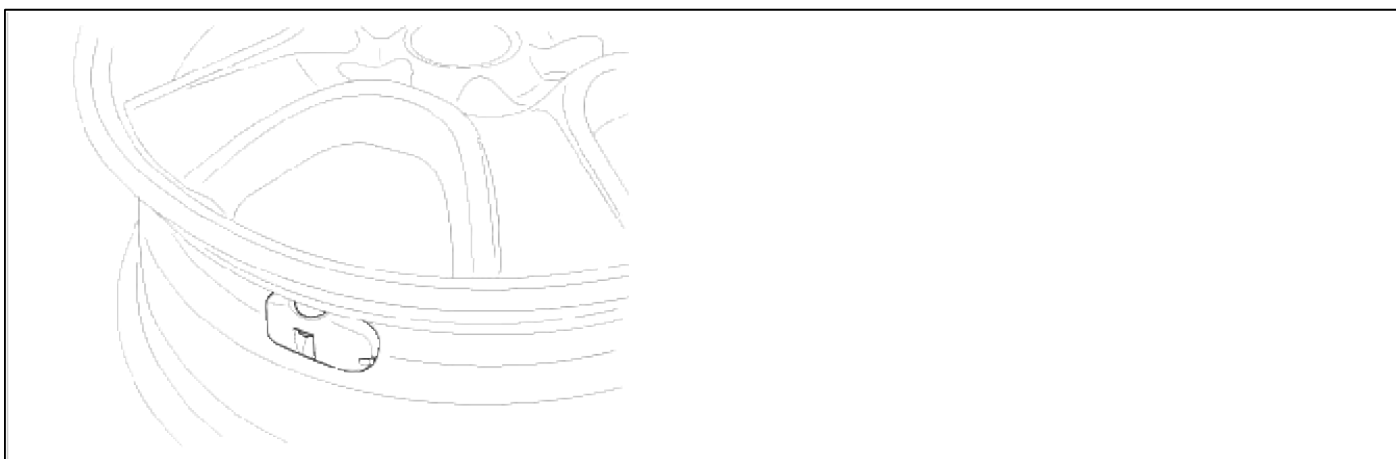
Go to the applicable troubleshooting procedure.

**NO**

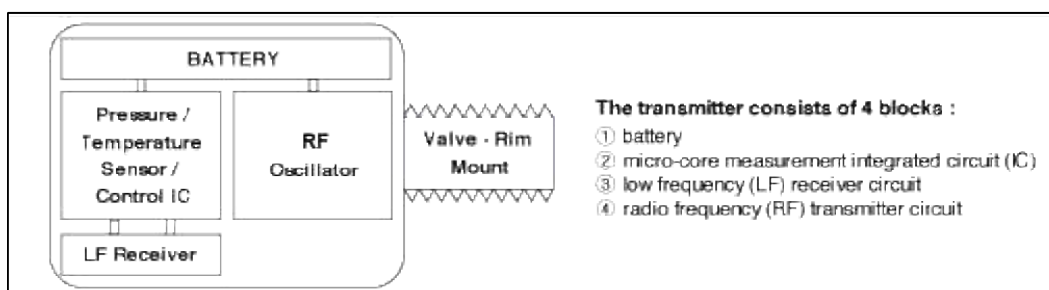
System performing to specification at this time.

## Suspension System > Troubleshooting > C1322

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the

same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

### DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

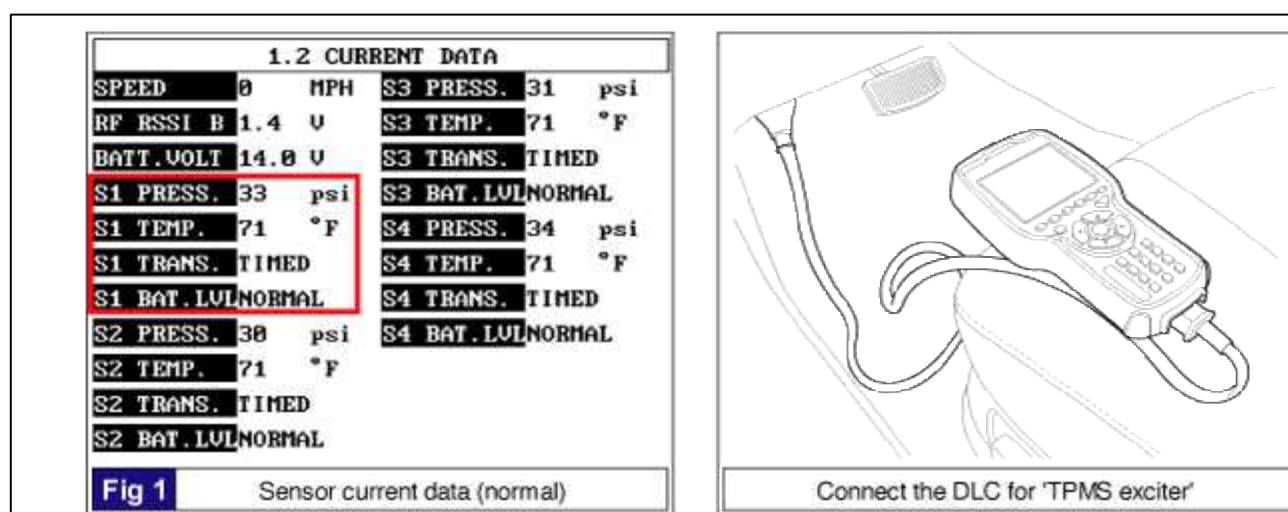
### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	<ul style="list-style-type: none"> <li>• Damaged tire</li> <li>• Excessive braking</li> <li>• Driving while the parking brake is on.</li> </ul>
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)



## 6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

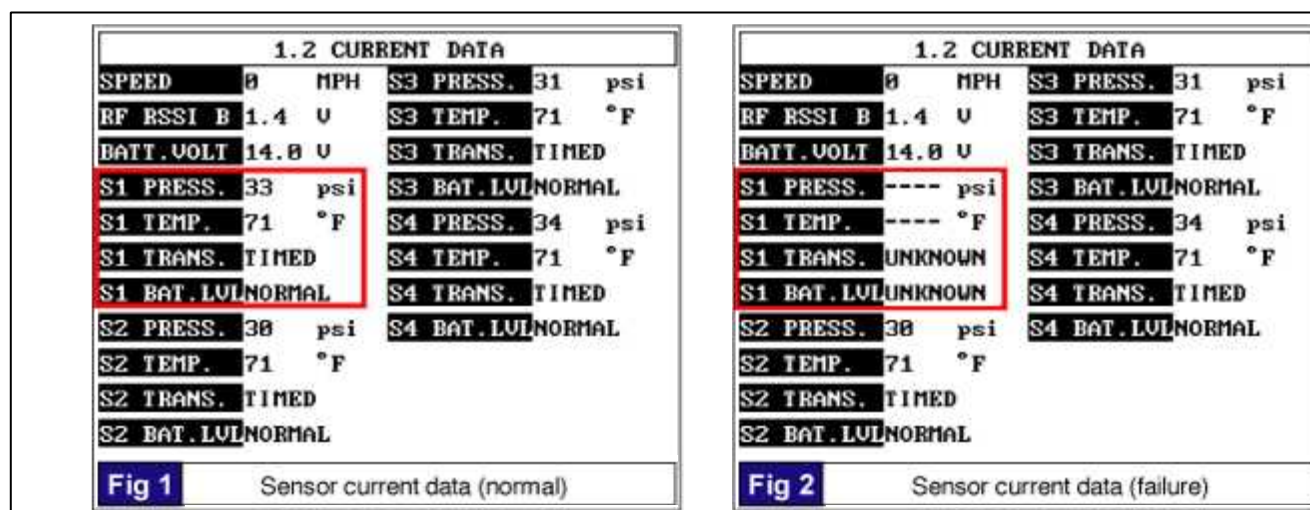
Go to "Component Inspection" procedure.

## Component Inspection

## Check TPM SENSOR 1

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.  
Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)



## 4. Is any sensor data outside specification?

**YES**

The sensor which displays data above the specification is SENSOR 1.  
Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as follows.

**NO**

Substitute with a known-good TPMS receiver module and check proper operation.

If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

## Check wheel / tire

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.



3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

**YES**

Fault can be because of temporary overheating.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Replace TPMS sensor and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

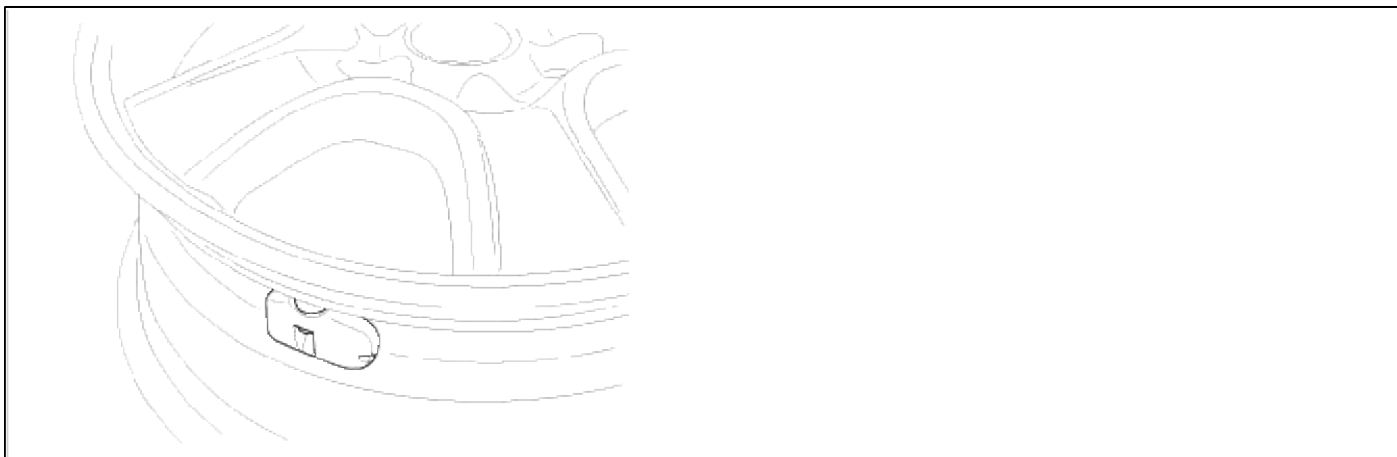
Go to the applicable troubleshooting procedure.

**NO**

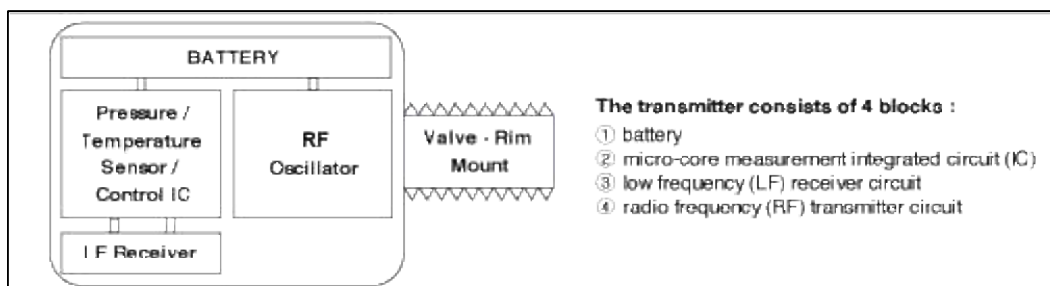
System performing to specification at this time.

## Suspension System > Troubleshooting > C1323

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and

transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### **Tire Pressure Monitoring**

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

### **DTC Description**

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

### **DTC Detecting Condition**

<b>Item</b>	<b>Detecting Condition</b>	<b>Possible cause</b>
DTC strategy	• Temperature of sensor check	<ul style="list-style-type: none"> <li>• Damaged tire</li> <li>• Excessive braking</li> <li>• Driving while the parking brake is on.</li> </ul>
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

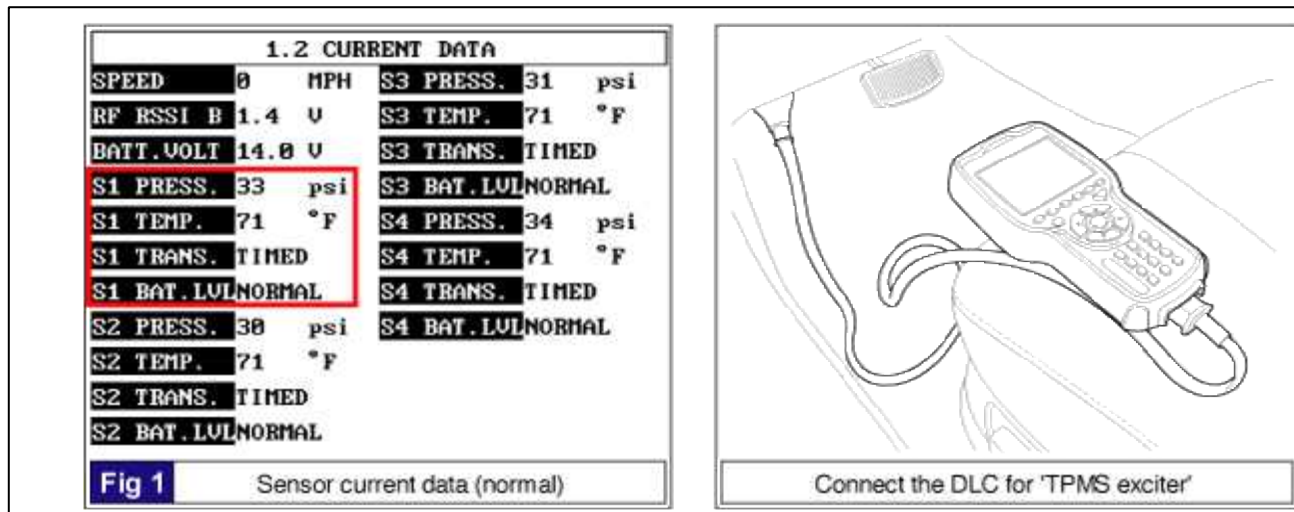
### **Monitor Scantool Data**

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.



5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

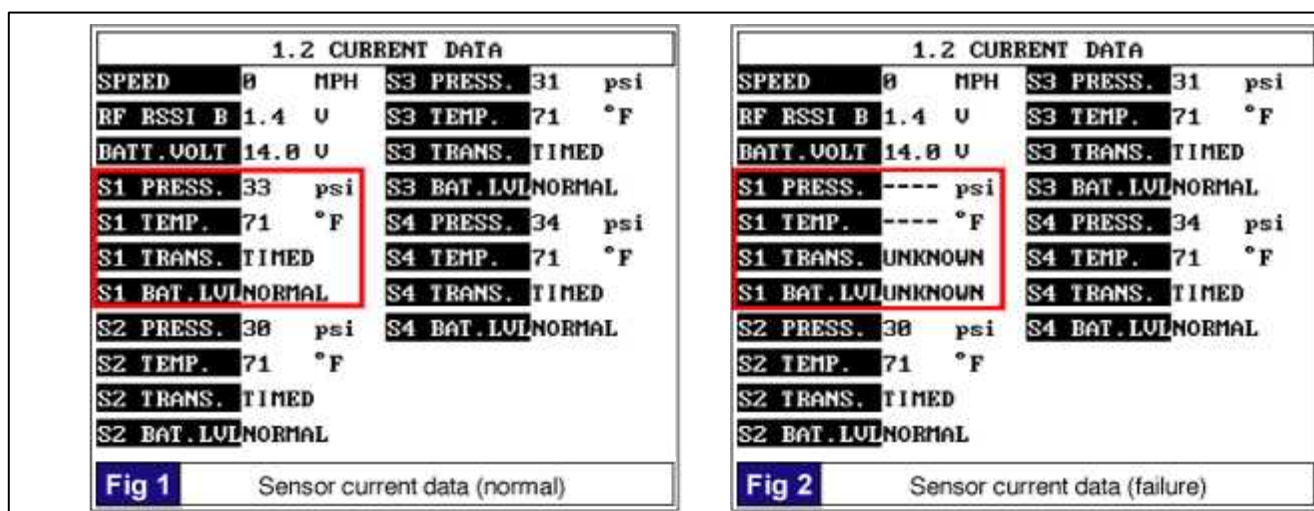
Go to "Component Inspection" procedure.

### Component Inspection

Check TPM SENSOR 1

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.  
Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)



## 4. Is any sensor data outside specification?

**YES**

The sensor which displays data above the specification is SENSOR 1.

Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as follows.

**NO**

Substitute with a known-good TPMS receiver module and check proper operation.

If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

Check wheel / tire

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

---

Specification : Less than 230 °F(110 °C)

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**YES**

Fault can be because of temporary overheating.

Go to "Verification of vehicle Repair" procedure.

**NO**

Replace TPMS sensor and register sensor ID with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

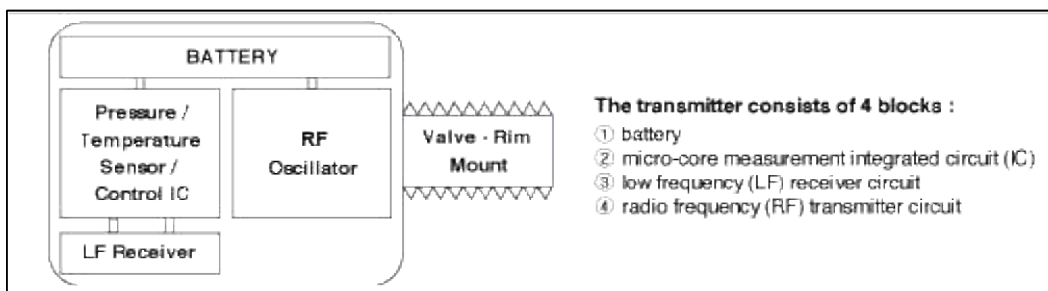
System performing to specification at this time.

## Suspension System > Troubleshooting > C1324

Component Location



## General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

### DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

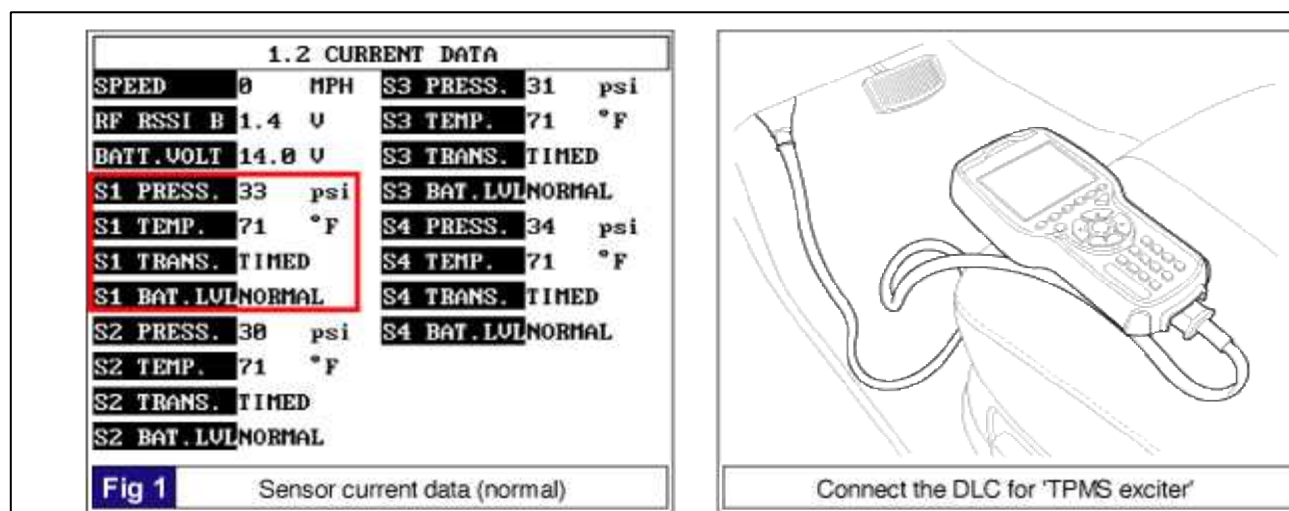
## DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	<ul style="list-style-type: none"> <li>• Damaged tire</li> <li>• Excessive braking</li> <li>• Driving while the parking brake is on.</li> </ul>
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

## Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

## Component Inspection

Check TPM SENSOR 1

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.  
Execute "SET SENSOR STATUS" of each wheel.

### 3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	33	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	71	°F	S4 PRESS.	34	psi
S1 TRANS.	TIMED		S4 TEMP.	71	°F
S1 BAT.LVL	NORMAL		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	U	S3 TEMP.	71	°F
BATT.VOLT	14.0	U	S3 TRANS.	TIMED	
S1 PRESS.	----	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	----	°F	S4 PRESS.	34	psi
S1 TRANS.	UNKNOWN		S4 TEMP.	71	°F
S1 BAT.LVL	UNKNOWN		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 2** Sensor current data (failure)

#### 4. Is any sensor data outside specification?

**YES**

The sensor which displays data above the specification is SENSOR 1.

Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as fellows.

**NO**

Substitute with a known-good TPMS receiver module and check proper operation.

If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

Check wheel / tire

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

**YES**

Fault can be because of temporary overheating.

Go to "Verification of vehicle Repair" procedure.

**NO**

Replace TPMS sensor and register sensor ID with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

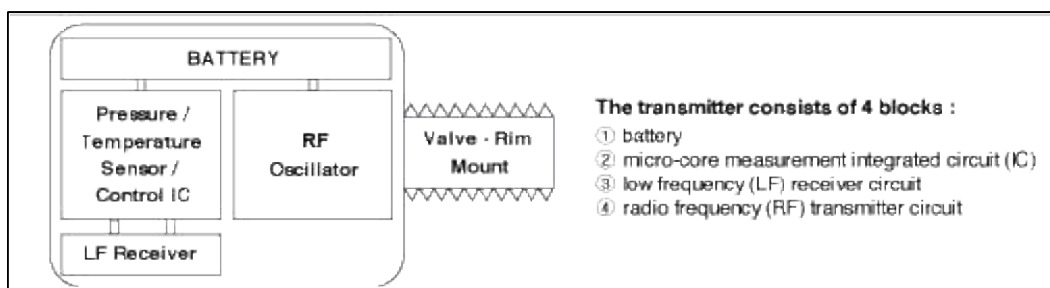
System performing to specification at this time.

## Suspension System > Troubleshooting > C1325

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at



a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120 °C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

#### DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

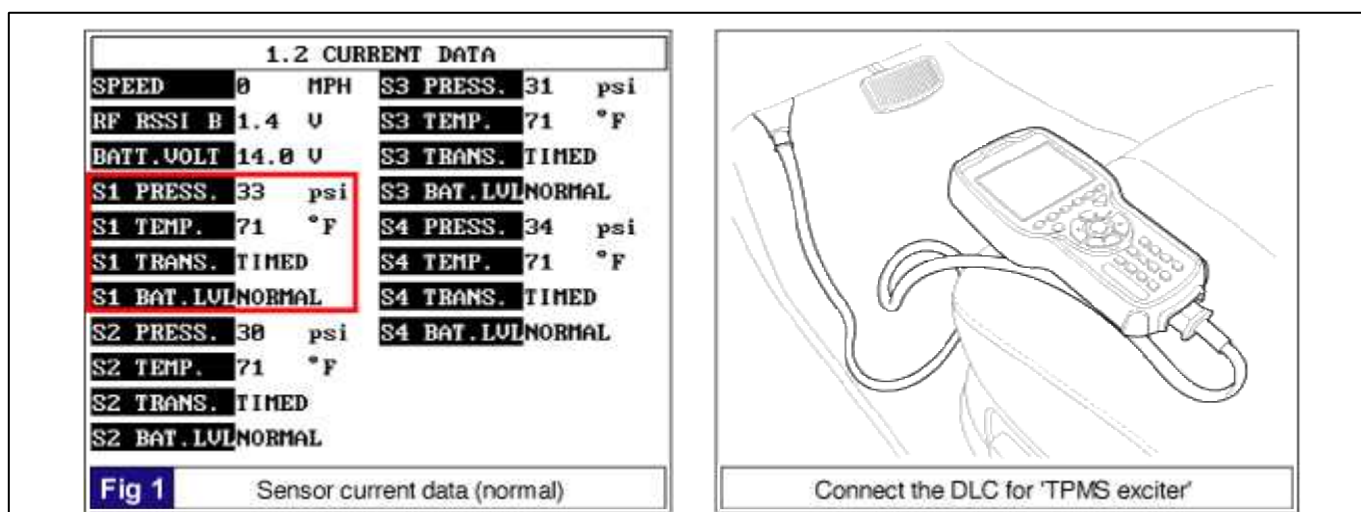
#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	<ul style="list-style-type: none"> <li>• Damaged tire</li> <li>• Excessive braking</li> <li>• Driving while the parking brake is on.</li> </ul>
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

#### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)



6. Is parameter within specifications?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

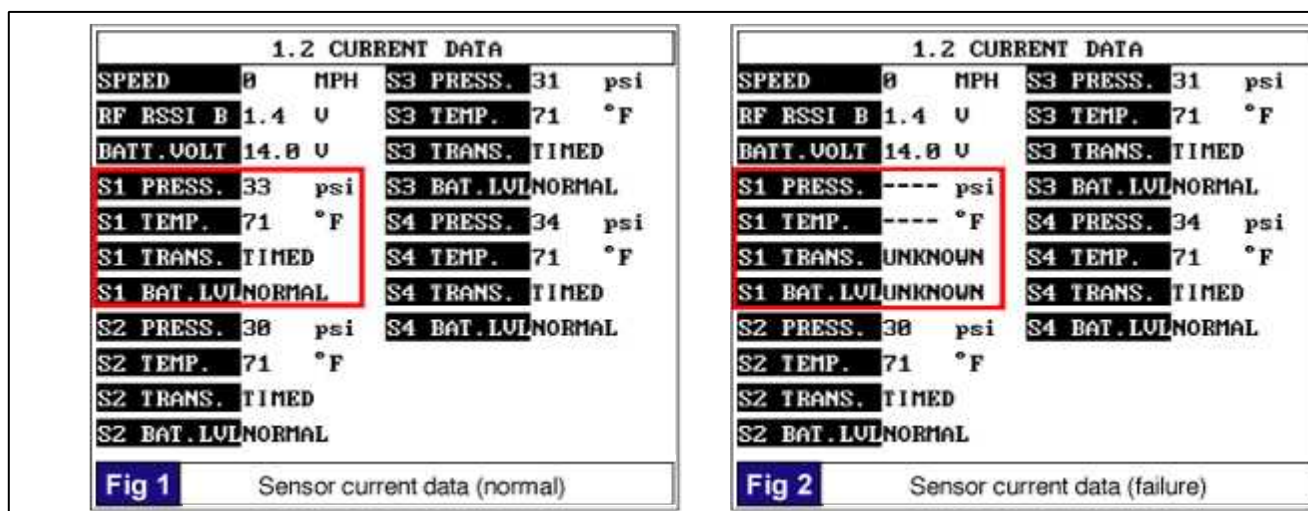
Go to "Component Inspection" procedure.

## Component Inspection

## Check TPM SENSOR 1

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.  
Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)



4. Is any sensor data outside specification?

**YES**

The sensor which displays data above the specification is SENSOR 1.

Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as follows.

**NO**

Substitute with a known-good TPMS receiver module and check proper operation.

If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

## Check wheel / tire

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.
3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

**YES**

Fault can be because of temporary overheating.

Go to "Verification of vehicle Repair" procedure.

**NO**

Replace TPMS sensor and register sensor ID with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.



1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

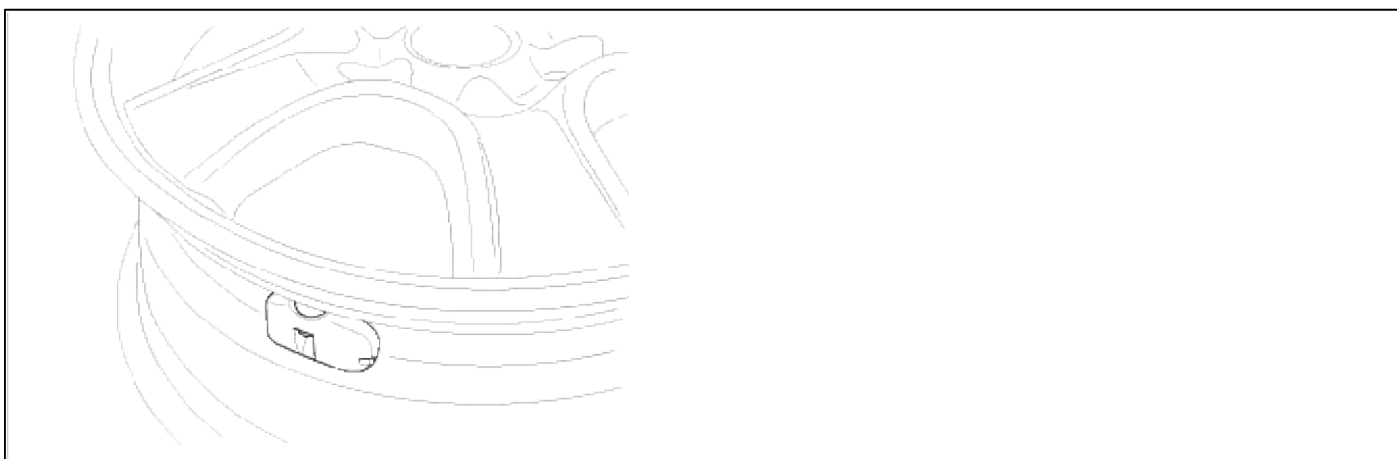
Go to the applicable troubleshooting procedure.

**NO**

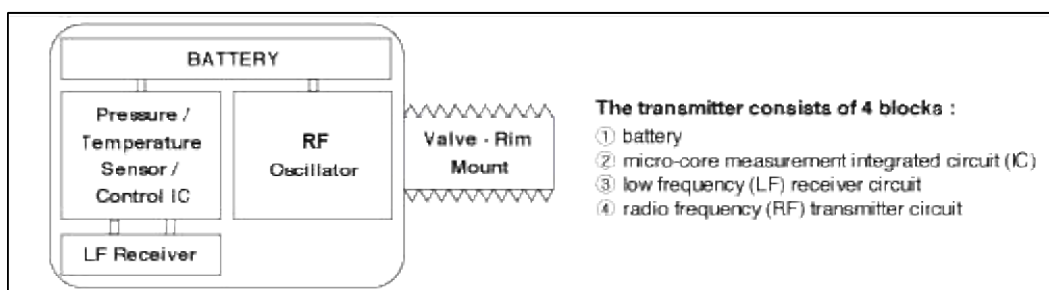
System performing to specification at this time.

## Suspension System > Troubleshooting > C1332

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the

same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

#### DTC Description

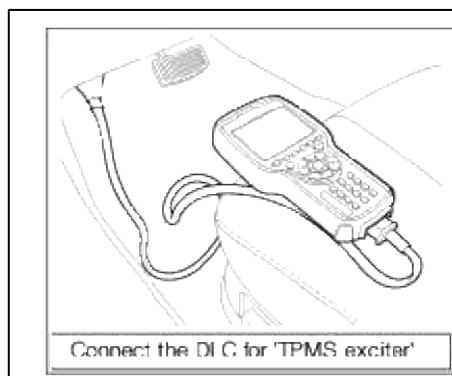
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>• Sensor check</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to sensor</li> <li>• Faulty TPMS sensor</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• An internal fault in the TPMS sensor</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• TPMS sensor fault</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>• &lt; 3min 24sec</li> </ul>	

#### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 3min 24sec.

1.2 CURRENT DATA			
SPEED	0	MPH	S3 PRESS. 31 psi
RF BSSI B	1.4	V	S3 TEMP. 71 °F
BATT.VOLT	14.0	V	S3 TRANS. TIMED
S1 PRESS.	33	psi	S3 BAT.LVLNORMAL
S1 TEMP.	71	°F	S4 PRESS. 34 psi
S1 TRANS.	TIMED		S4 TEMP. 71 °F
S1 BAT.LVL	NORMAL		S4 TRANS. TIMED
S2 PRESS.	30	psi	S4 BAT.LVLNORMAL
S2 TEMP.	71	°F	
S2 TRANS.	TIMED		
S2 BAT.LVL	NORMAL		

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA			
SPEED	0	MPH	S3 PRESS. 31 psi
RF BSSI B	1.4	V	S3 TEMP. 71 °F
BATT.VOLT	14.0	V	S3 TRANS. TIMED
S1 PRESS.	----	psi	S3 BAT.LVLNORMAL
S1 TEMP.	----	°F	S4 PRESS. 34 psi
S1 TRANS.	UNKNOWN		S4 TEMP. 71 °F
S1 BAT.LVL	UNKNOWN		S4 TRANS. TIMED
S2 PRESS.	30	psi	S4 BAT.LVLNORMAL
S2 TEMP.	71	°F	
S2 TRANS.	TIMED		
S2 BAT.LVL	NORMAL		

**Fig 2** Sensor current data (failure)

6. Is parameter normal?

**YES**

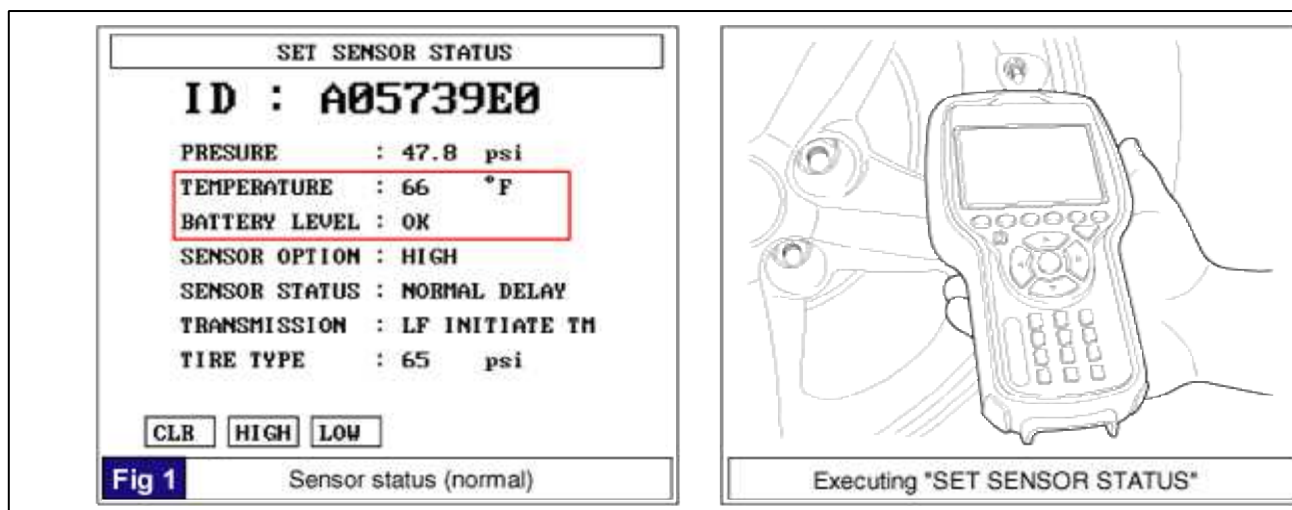
Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.



4. Is data unable to be retrieved for any sensor?

**YES**

Check for damaged of TPMS sensor on affected wheel.  
Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.  
If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

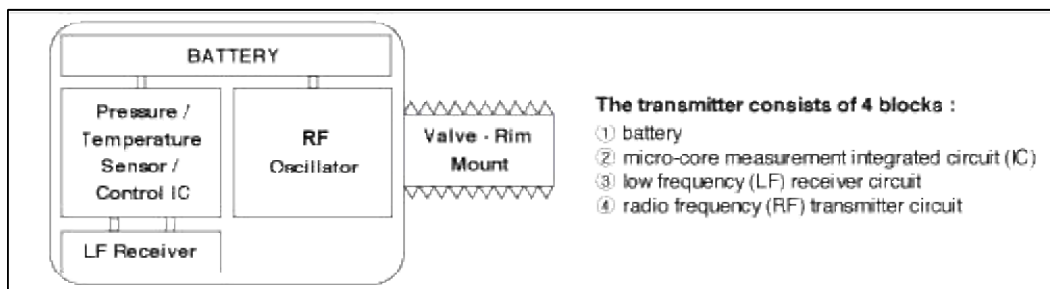
System performing to specification at this time.

## Suspension System > Troubleshooting > C1333

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

#### DTC Description

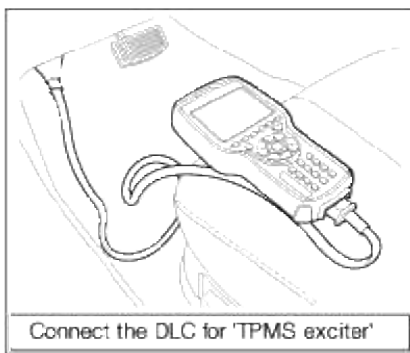
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>• Sensor check</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to sensor</li> <li>• Faulty TPMS sensor</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• An internal fault in the TPMS sensor</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• TPMS sensor fault</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>• &lt; 3min 24sec</li> </ul>	

#### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 3min 24sec.

1.2 CURRENT DATA			
SPEED	0	MPH	S3 PRESS. 31 psi
RF BSSI B	1.4	V	S3 TEMP. 71 °F
BATT.VOLT	14.0	V	S3 TRANS. TIMED
S1 PRESS.	33	psi	S3 BAT.LVLNORMAL
S1 TEMP.	71	°F	S4 PRESS. 34 psi
S1 TRANS.	TIMED		S4 TEMP. 71 °F
S1 BAT.LVL	NORMAL		S4 TRANS. TIMED
S2 PRESS.	30	psi	S4 BAT.LVLNORMAL
S2 TEMP.	71	°F	
S2 TRANS.	TIMED		
S2 BAT.LVL	NORMAL		

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA			
SPEED	0	MPH	S3 PRESS. 31 psi
RF BSSI B	1.4	V	S3 TEMP. 71 °F
BATT.VOLT	14.0	V	S3 TRANS. TIMED
S1 PRESS.	----	psi	S3 BAT.LVLNORMAL
S1 TEMP.	----	°F	S4 PRESS. 34 psi
S1 TRANS.	UNKNOWN		S4 TEMP. 71 °F
S1 BAT.LVL	UNKNOWN		S4 TRANS. TIMED
S2 PRESS.	30	psi	S4 BAT.LVLNORMAL
S2 TEMP.	71	°F	
S2 TRANS.	TIMED		
S2 BAT.LVL	NORMAL		

**Fig 2** Sensor current data (failure)

6. Is parameter normal?

**YES**

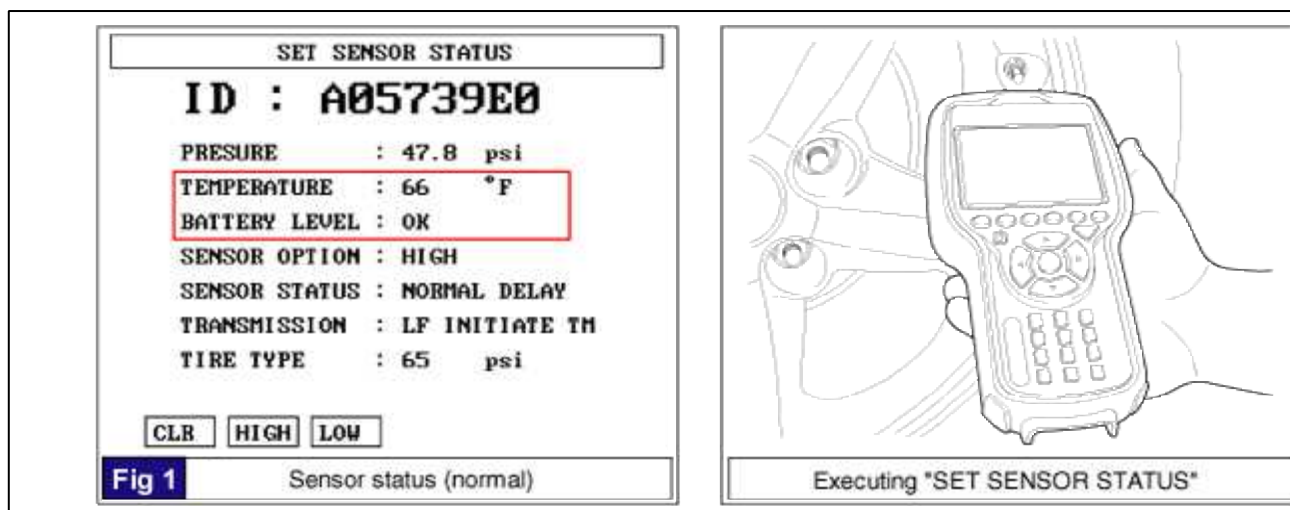
Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.



4. Is data unable to be retrieved for any sensor?

**YES**

Check for damaged of TPMS sensor on affected wheel.  
Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.  
If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

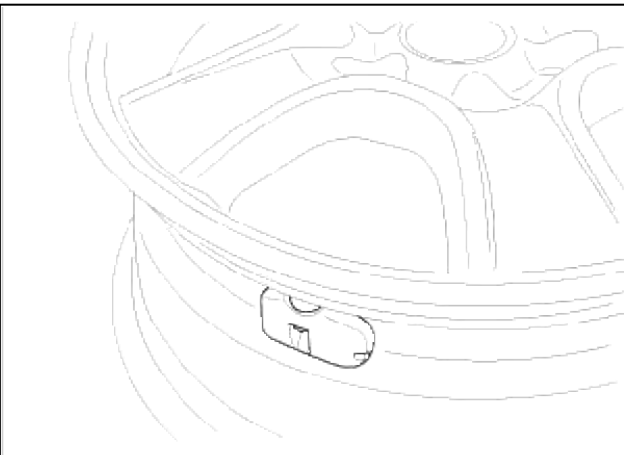
Go to the applicable troubleshooting procedure.

**NO**

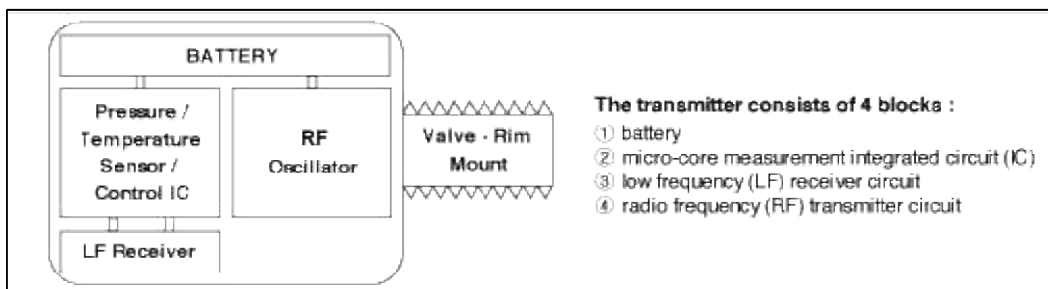
System performing to specification at this time.

## Suspension System > Troubleshooting > C1334

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring



When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

#### DTC Description

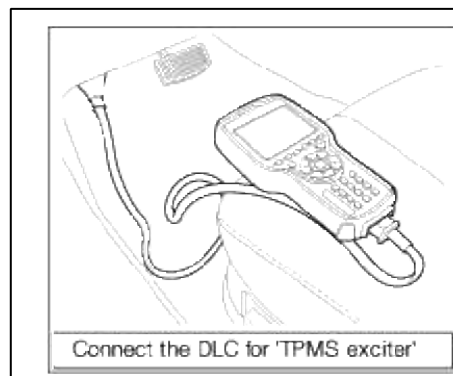
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>• Sensor check</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to sensor</li> <li>• Faulty TPMS sensor</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• An internal fault in the TPMS sensor</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• TPMS sensor fault</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>• &lt; 3min 24sec</li> </ul>	

#### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.



5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 3min 24sec.

1.2 CURRENT DATA			
SPEED	0	MPH	S3 PRESS. 31 psi
RF BSSI B	1.4	V	S3 TEMP. 71 °F
BATT.VOLT	14.0	V	S3 TRANS. TIMED
S1 PRESS.	33	psi	S3 BAT.LVLNORMAL
S1 TEMP.	71	°F	S4 PRESS. 34 psi
S1 TRANS.	TIMED		S4 TEMP. 71 °F
S1 BAT.LVL	NORMAL		S4 TRANS. TIMED
S2 PRESS.	30	psi	S4 BAT.LVLNORMAL
S2 TEMP.	71	°F	
S2 TRANS.	TIMED		
S2 BAT.LVL	NORMAL		

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA			
SPEED	0	MPH	S3 PRESS. 31 psi
RF BSSI B	1.4	V	S3 TEMP. 71 °F
BATT.VOLT	14.0	V	S3 TRANS. TIMED
S1 PRESS.	----	psi	S3 BAT.LVLNORMAL
S1 TEMP.	----	°F	S4 PRESS. 34 psi
S1 TRANS.	UNKNOWN		S4 TEMP. 71 °F
S1 BAT.LVL	UNKNOWN		S4 TRANS. TIMED
S2 PRESS.	30	psi	S4 BAT.LVLNORMAL
S2 TEMP.	71	°F	
S2 TRANS.	TIMED		
S2 BAT.LVL	NORMAL		

**Fig 2** Sensor current data (failure)

6. Is parameter normal?

**YES**

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

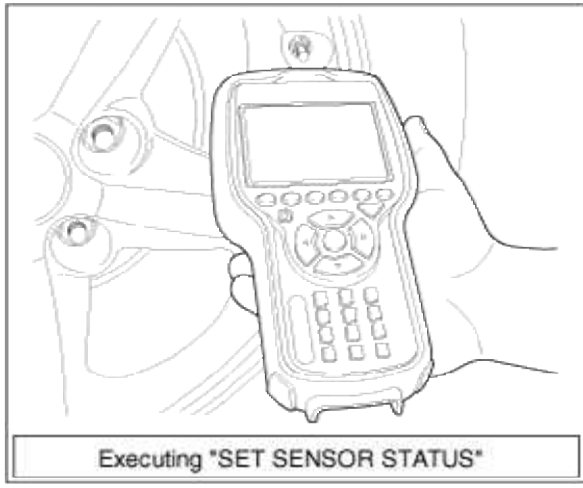
Go to "Component Inspection" procedure.

### Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

SET SENSOR STATUS	
<b>ID : A05739E0</b>	
PRESURE	: 47.8 psi
TEMPERATURE	: 66 °F
BATTERY LEVEL	: OK
SENSOR OPTION	: HIGH
SENSOR STATUS	: NORMAL DELAY
TRANSMISSION	: LF INITIATE TM
TIRE TYPE	: 65 psi
CLB	HIGH LOW

**Fig 1** Sensor status (normal)



Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

**YES**

Check for damaged of TPMS sensor on affected wheel.  
Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.

If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

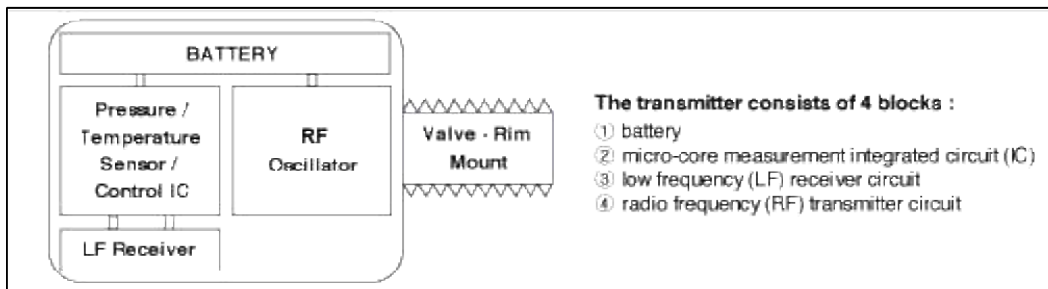
System performing to specification at this time.

## Suspension System > Troubleshooting > C1335

### Component Location



### General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is  $\pm 5^{\circ}\text{C}$  at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

### Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be  $\pm 7$  kPa from 0 to 50 °C and  $\pm 17.5$  kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be  $\pm 3$  °C from -20 to 70 °C and to  $\pm 5$  °C from -40 to 120 °C.

#### DTC Description

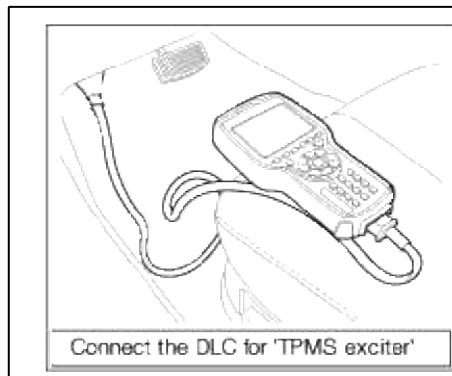
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>• Sensor check</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to sensor</li> <li>• Faulty TPMS sensor</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• An internal fault in the TPMS sensor</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>• TPMS sensor fault</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>• &lt; 3min 24sec</li> </ul>	

#### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 3min 24sec.

1.2 CURRENT DATA			
SPEED	0	MPH	S3 PRESS. 31 psi
RF BSSI B	1.4	V	S3 TEMP. 71 °F
BATT.VOLT	14.0	V	S3 TRANS. TIMED
S1 PRESS.	33	psi	S3 BAT.LVLNORMAL
S1 TEMP.	71	°F	S4 PRESS. 34 psi
S1 TRANS.	TIMED		S4 TEMP. 71 °F
S1 BAT.LVL	NORMAL		S4 TRANS. TIMED
S2 PRESS.	30	psi	S4 BAT.LVLNORMAL
S2 TEMP.	71	°F	
S2 TRANS.	TIMED		
S2 BAT.LVL	NORMAL		

**Fig 1** Sensor current data (normal)

1.2 CURRENT DATA			
SPEED	0	MPH	S3 PRESS. 31 psi
RF BSSI B	1.4	V	S3 TEMP. 71 °F
BATT.VOLT	14.0	V	S3 TRANS. TIMED
S1 PRESS.	----	psi	S3 BAT.LVLNORMAL
S1 TEMP.	----	°F	S4 PRESS. 34 psi
S1 TRANS.	UNKNOWN		S4 TEMP. 71 °F
S1 BAT.LVL	UNKNOWN		S4 TRANS. TIMED
S2 PRESS.	30	psi	S4 BAT.LVLNORMAL
S2 TEMP.	71	°F	
S2 TRANS.	TIMED		
S2 BAT.LVL	NORMAL		

**Fig 2** Sensor current data (failure)

6. Is parameter normal?

**YES**

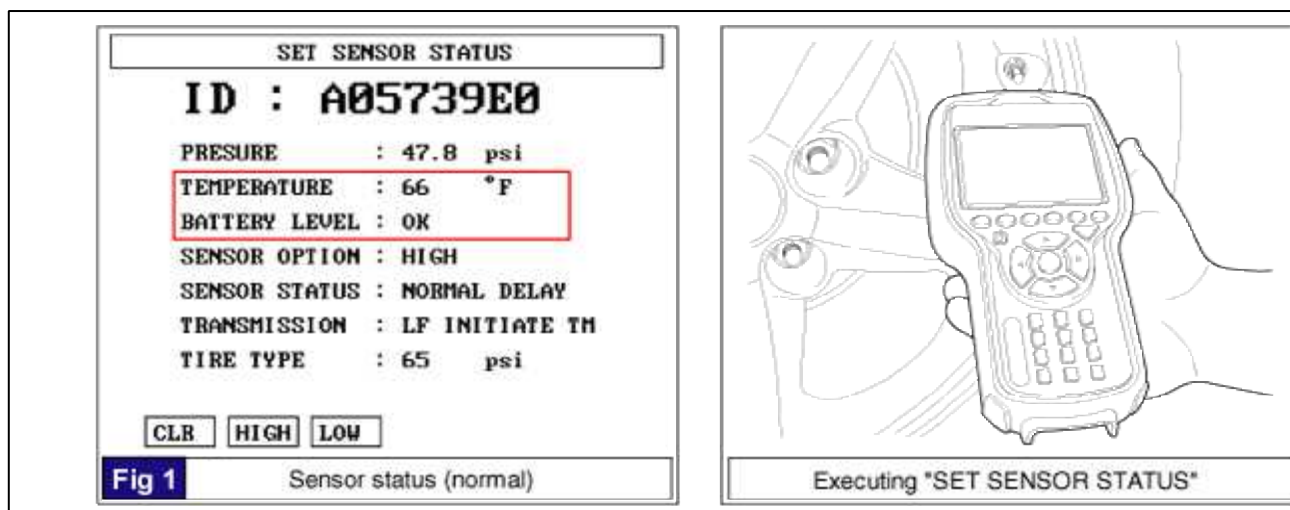
Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure.

### Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.



4. Is data unable to be retrieved for any sensor?

**YES**

Check for damaged of TPMS sensor on affected wheel.  
Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good TPM receiver module and check for proper operation.  
If the problem is corrected, replace TPM receiver module and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

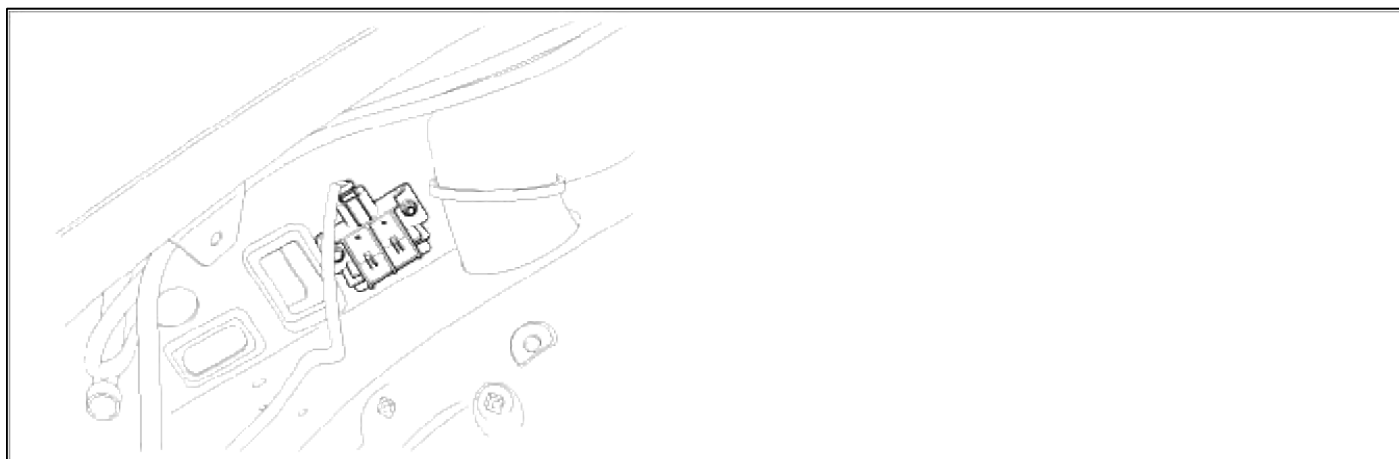
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1341

### Component Location



### General Description

The LFI is located at each vehicle wheel house (FL, FR, RL, RR) High-Line systems are fitted with LFI units. An LFI unit is mounted in each wheel well of a vehicle to enable the Receiver unit to determine the vehicle position of each WE for which it has a stored ID code. Using a digital bi-directional serial control line to each LFI, the Receiver can activate an LFI to send out an LF message and trigger the WE sensor near its location to respond with an RF transmission. By activating the LFI units one at a time, the Receiver can automatically locate the vehicle position of each WE. For fault detection, the LFI will report back its "operating properly" status to the receiver via the control line.

The transmitter is capable of receiving an LF signal from a Low Frequency Initiator (LFI) mounted in the wheel well. The transmitter responds to a valid command from the LFI with a RF respond. The transmitter changes from Normal state to Storage state and from Storage state to Normal state with a valid command from the LFI with a RF response. The LF communication prolongs battery life (through state changes) and determines sensor location (through one-to-one handshaking between LFI and transmitter).

### DTC Description

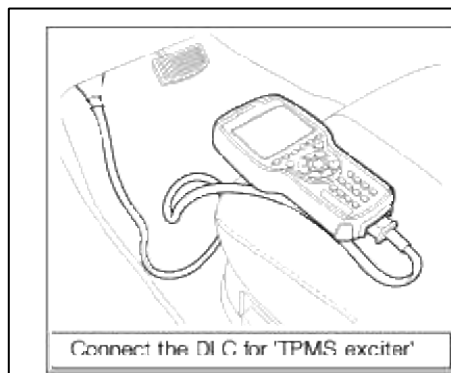
This DTC indicates that Auto-location timing is completed and ECU did not receive a datagram from the FL/FR/RL/RR WE sensor due to LFI trigger. The most likely cause is a transmission obstacle.

### DTC Detecting Condition

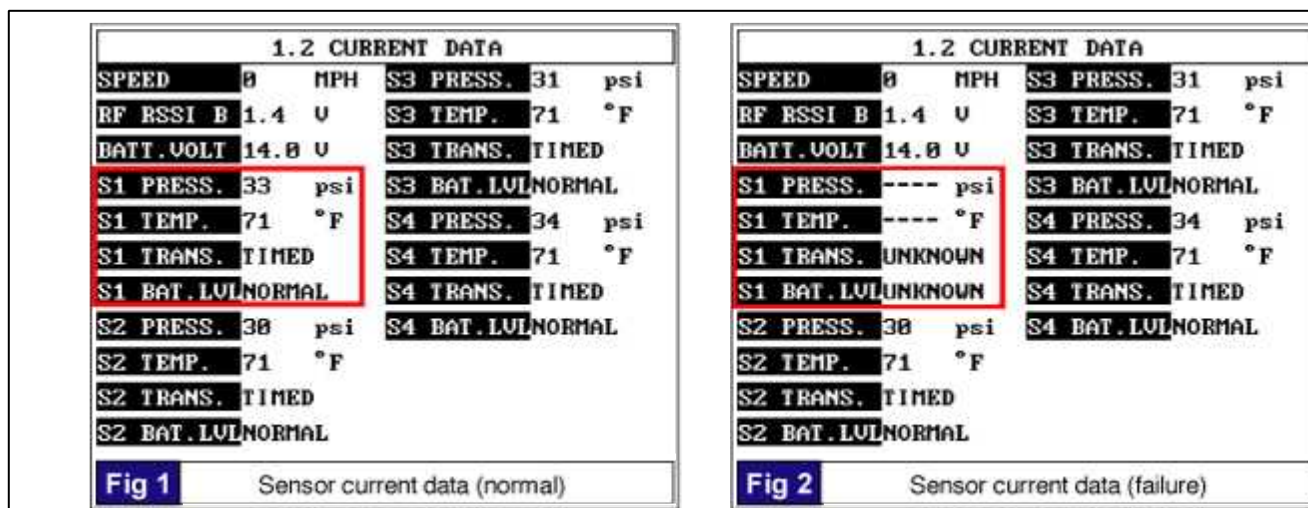
Item	Detecting Condition	Possible cause
DTC strategy	• LF/ RF check	<ul style="list-style-type: none"> <li>• Faulty harness/ Connection</li> <li>• Sensors incorrectly configured as low line.</li> <li>• Faulty TPMS initiator</li> <li>• Faulty TPMS receiver</li> <li>• Shielding in/ on vehicle.</li> <li>• Incorrectly fitted sensor/ Initiator</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• No initiated RF message received from any sensor after LF try from initiator</li> <li>• 4km &lt; Distance traveled during 12min. &lt; 40km</li> </ul>	
Threshold value	• No initiated messages received during Auto-location.	
Diagnosis time	• 12~13 minutes - once per ignition cycle on Auto-locate.	

### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of sensor on the 'TPMS exciter' or scan tool after 13minutes.



6. Is parameter normal?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Check for vehicle interference sources.  
Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

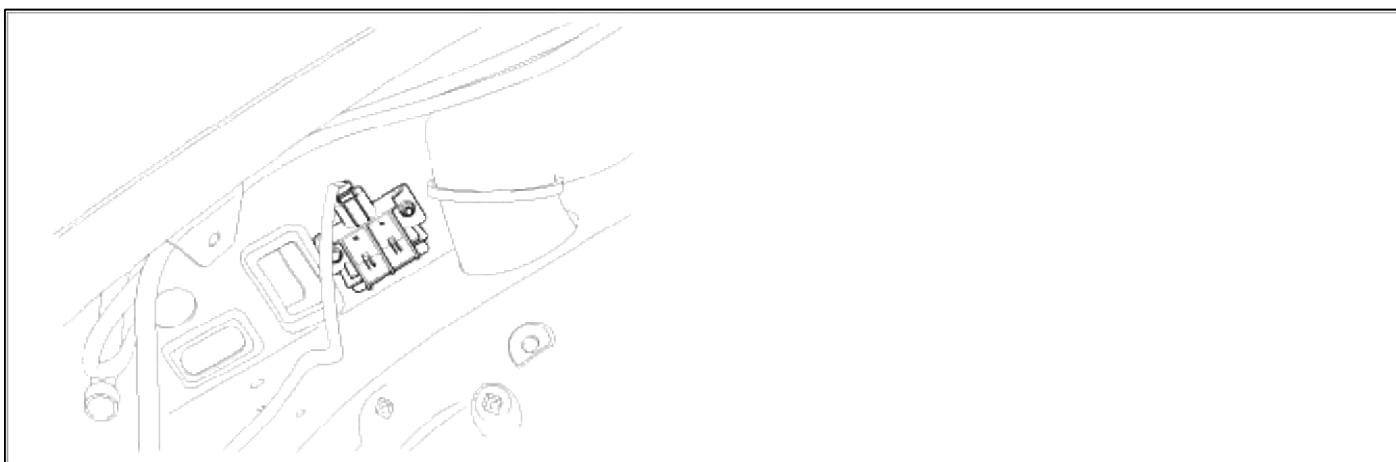
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1342

### Component Location



### General Description

The LFI is located at each vehicle wheel house (FL, FR, RL, RR) High-Line systems are fitted with LFI units. An LFI unit is mounted in each wheel well of a vehicle to enable the Receiver unit to determine the vehicle position of each WE for which it has a stored ID code. Using a digital bi-directional serial control line to each LFI, the Receiver can activate an LFI to send out an LF message and trigger the WE sensor near its location to respond with an RF transmission. By activating the LFI units one at a time, the Receiver can automatically locate the vehicle position of each WE. For fault detection, the LFI will report back its "operating properly" status to the receiver via the control line.

The transmitter is capable of receiving an LF signal from a Low Frequency Initiator (LFI) mounted in the wheel well. The transmitter responds to a valid command from the LFI with a RF respond. The transmitter changes from Normal state to Storage state and from Storage state to Normal state with a valid command from the LFI with a RF response. The LF communication prolongs battery life (through state changes) and determines sensor location (through one-to-one handshaking between LFI and transmitter).

### DTC Description

This DTC indicates that Auto-location timing is completed and ECU did not receive a datagram from the FL/FR/RL/RR WE sensor due to LFI trigger. The most likely cause is a transmission obstacle.

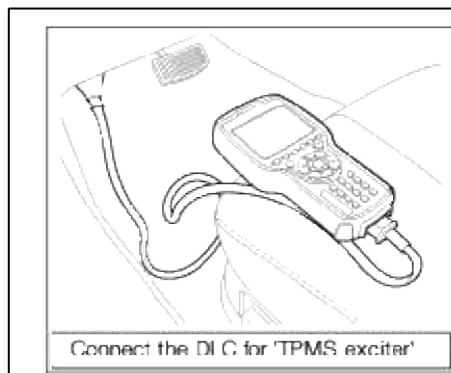
### DTC Detecting Condition



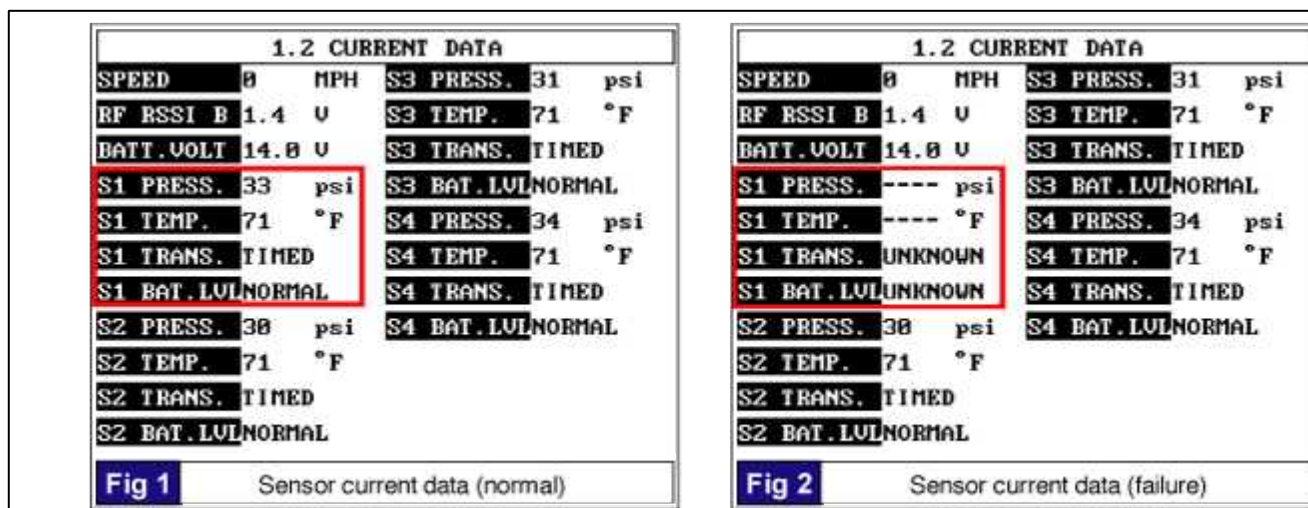
Item	Detecting Condition	Possible cause
DTC strategy	• LF/ RF check	<ul style="list-style-type: none"> <li>• Faulty harness/ Connection</li> <li>• Sensors incorrectly configured as low line.</li> <li>• Faulty TPMS initiator</li> <li>• Faulty TPMS receiver</li> <li>• Shielding in/ on vehicle.</li> <li>• Incorrectly fitted sensor/ Initiator</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• No initiated RF message received from any sensor after LF try from initiator</li> <li>• 4km &lt; Distance traveled during 12min. &lt; 40km</li> </ul>	
Threshold value	• No initiated messages received during Auto-location.	
Diagnosis time	• 12~13 minutes - once per ignition cycle on Auto-locate.	

### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of sensor on the 'TPMS exciter' or scan tool after 13minutes.



6. Is parameter normal?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Check for vehicle interference sources.  
Repair if necessary and then go to "Verification of Vehicle Repair" procedure.



## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

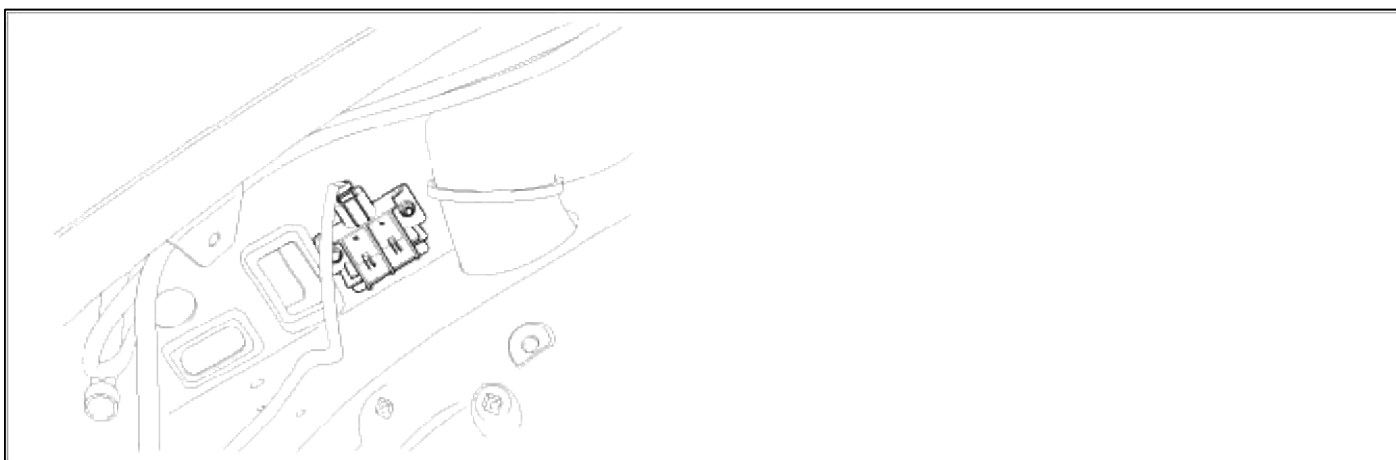
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1343

### Component Location



### General Description

The LFI is located at each vehicle wheel house (FL, FR, RL, RR) High-Line systems are fitted with LFI units. An LFI unit is mounted in each wheel well of a vehicle to enable the Receiver unit to determine the vehicle position of each WE for which it has a stored ID code. Using a digital bi-directional serial control line to each LFI, the Receiver can activate an LFI to send out an LF message and trigger the WE sensor near its location to respond with an RF transmission. By activating the LFI units one at a time, the Receiver can automatically locate the vehicle position of each WE. For fault detection, the LFI will report back its "operating properly" status to the receiver via the control line.

The transmitter is capable of receiving an LF signal from a Low Frequency Initiator (LFI) mounted in the wheel well. The transmitter responds to a valid command from the LFI with a RF respond. The transmitter changes from Normal state to Storage state and from Storage state to Normal state with a valid command from the LFI with a RF response. The LF communication prolongs battery life (through state changes) and determines sensor location (through one-to-one handshaking between LFI and transmitter).

### DTC Description

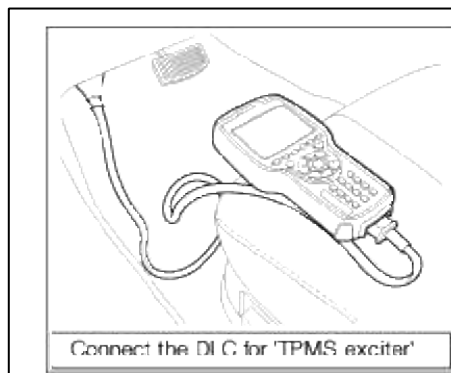
This DTC indicates that Auto-location timing is completed and ECU did not receive a datagram from the FL/FR/RL/RR WE sensor due to LFI trigger. The most likely cause is a transmission obstacle.

### DTC Detecting Condition

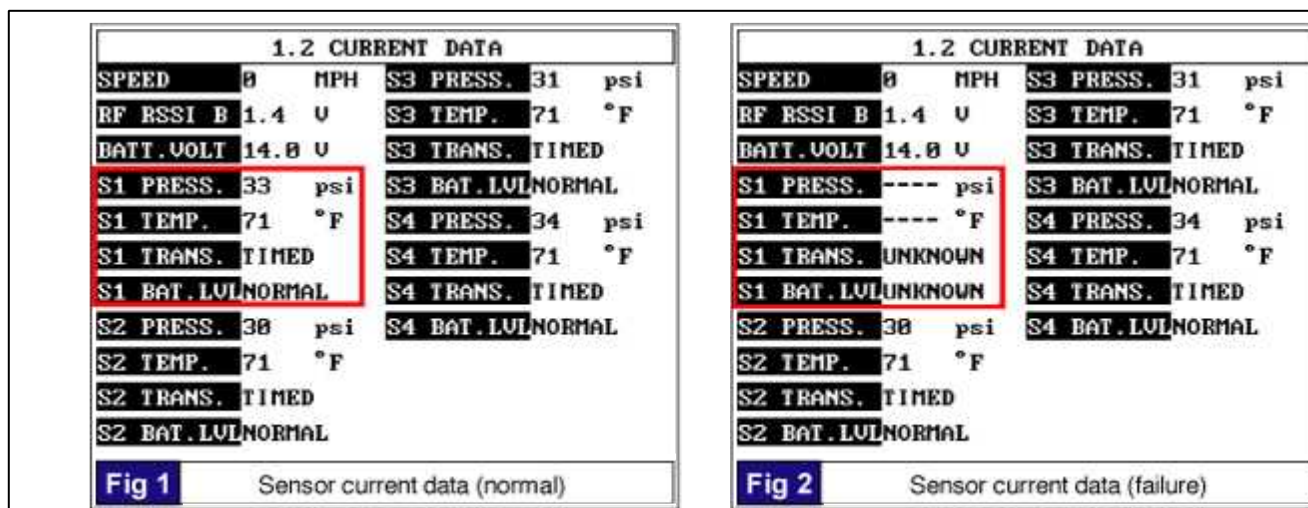
Item	Detecting Condition	Possible cause
DTC strategy	• LF/ RF check	<ul style="list-style-type: none"> <li>• Faulty harness/ Connection</li> <li>• Sensors incorrectly configured as low line.</li> <li>• Faulty TPMS initiator</li> <li>• Faulty TPMS receiver</li> <li>• Shielding in/ on vehicle.</li> <li>• Incorrectly fitted sensor/ Initiator</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• No initiated RF message received from any sensor after LF try from initiator</li> <li>• 4km &lt; Distance traveled during 12min. &lt; 40km</li> </ul>	
Threshold value	• No initiated messages received during Auto-location.	
Diagnosis time	• 12~13 minutes - once per ignition cycle on Auto-locate.	

### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of sensor on the 'TPMS exciter' or scan tool after 13minutes.



6. Is parameter normal?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Check for vehicle interference sources.  
Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

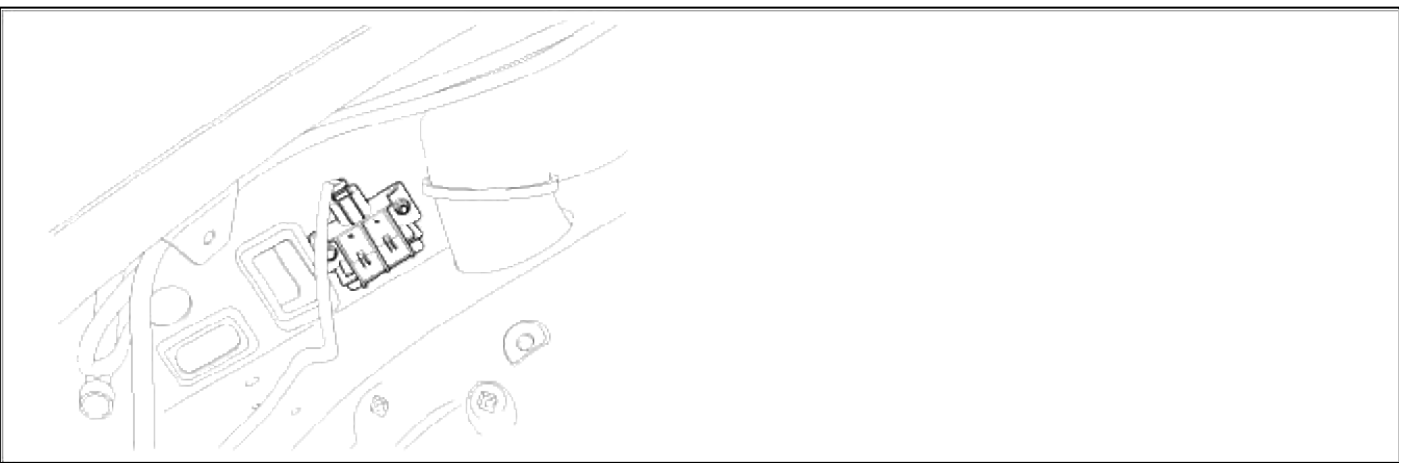
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1344

### Component Location



### General Description

The LFI is located at each vehicle wheel house (FL, FR, RL, RR) High-Line systems are fitted with LFI units. An LFI unit is mounted in each wheel well of a vehicle to enable the Receiver unit to determine the vehicle position of each WE for which it has a stored ID code. Using a digital bi-directional serial control line to each LFI, the Receiver can activate an LFI to send out an LF message and trigger the WE sensor near its location to respond with an RF transmission. By activating the LFI units one at a time, the Receiver can automatically locate the vehicle position of each WE. For fault detection, the LFI will report back its "operating properly" status to the receiver via the control line.

The transmitter is capable of receiving an LF signal from a Low Frequency Initiator (LFI) mounted in the wheel well. The transmitter responds to a valid command from the LFI with a RF respond. The transmitter changes from Normal state to Storage state and from Storage state to Normal state with a valid command from the LFI with a RF response. The LF communication prolongs battery life (through state changes) and determines sensor location (through one-to-one handshaking between LFI and transmitter).

### DTC Description

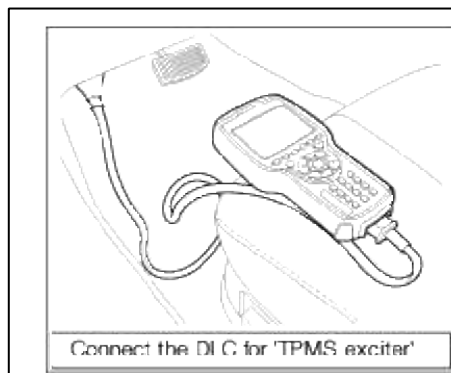
This DTC indicates that Auto-location timing is completed and ECU did not receive a datagram from the FL/FR/RL/RR WE sensor due to LFI trigger. The most likely cause is a transmission obstacle.

### DTC Detecting Condition

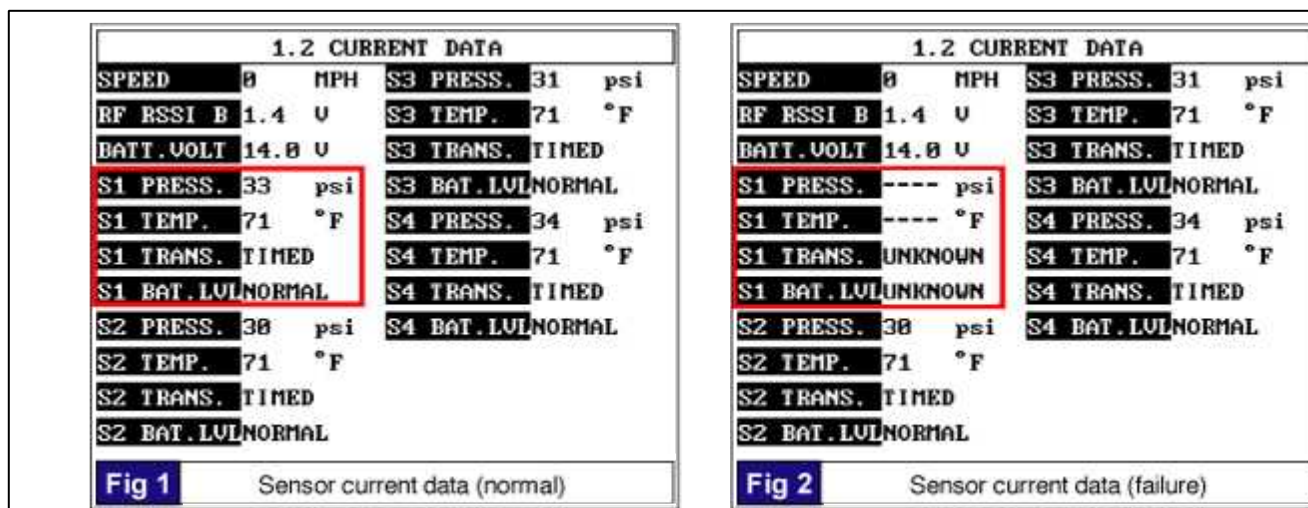
Item	Detecting Condition	Possible cause
DTC strategy	• LF/ RF check	<ul style="list-style-type: none"> <li>• Faulty harness/ Connection</li> <li>• Sensors incorrectly configured as low line.</li> <li>• Faulty TPMS initiator</li> <li>• Faulty TPMS receiver</li> <li>• Shielding in/ on vehicle.</li> <li>• Incorrectly fitted sensor/ Initiator</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• No initiated RF message received from any sensor after LF try from initiator</li> <li>• 4km &lt; Distance traveled during 12min. &lt; 40km</li> </ul>	
Threshold value	• No initiated messages received during Auto-location.	
Diagnosis time	• 12~13 minutes - once per ignition cycle on Auto-locate.	

### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of sensor on the 'TPMS exciter' or scan tool after 13minutes.



6. Is parameter normal?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of vehicle Repair" procedure.

**NO**

Check for vehicle interference sources.  
Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

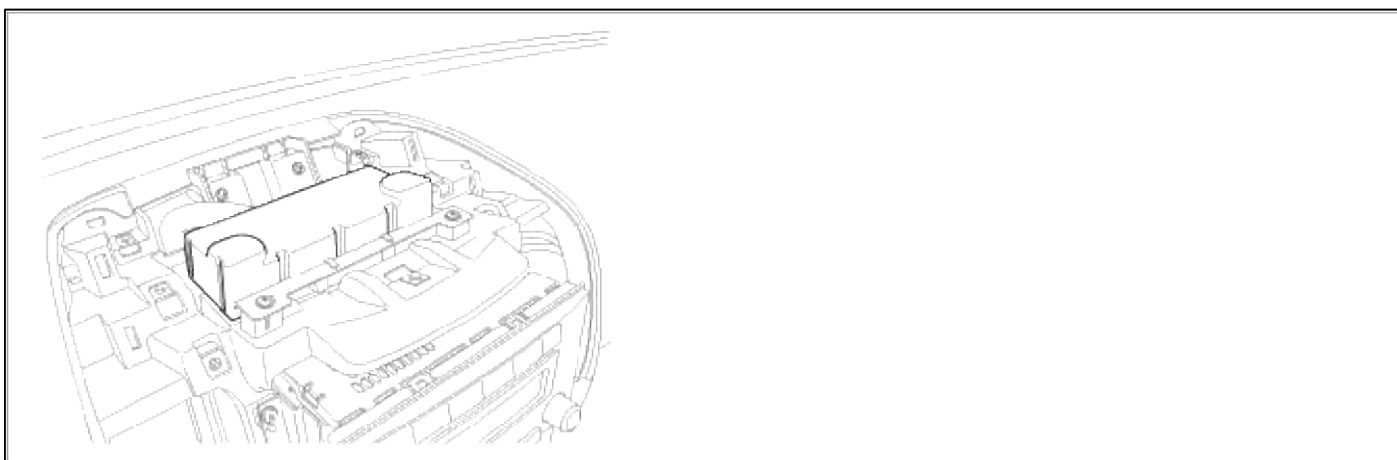
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1660

### Component Location



### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

### DTC Description

This DTC indicates that the receiver has not received any RF messages. The most likely cause is receiver RF circuit failure / RF screening.

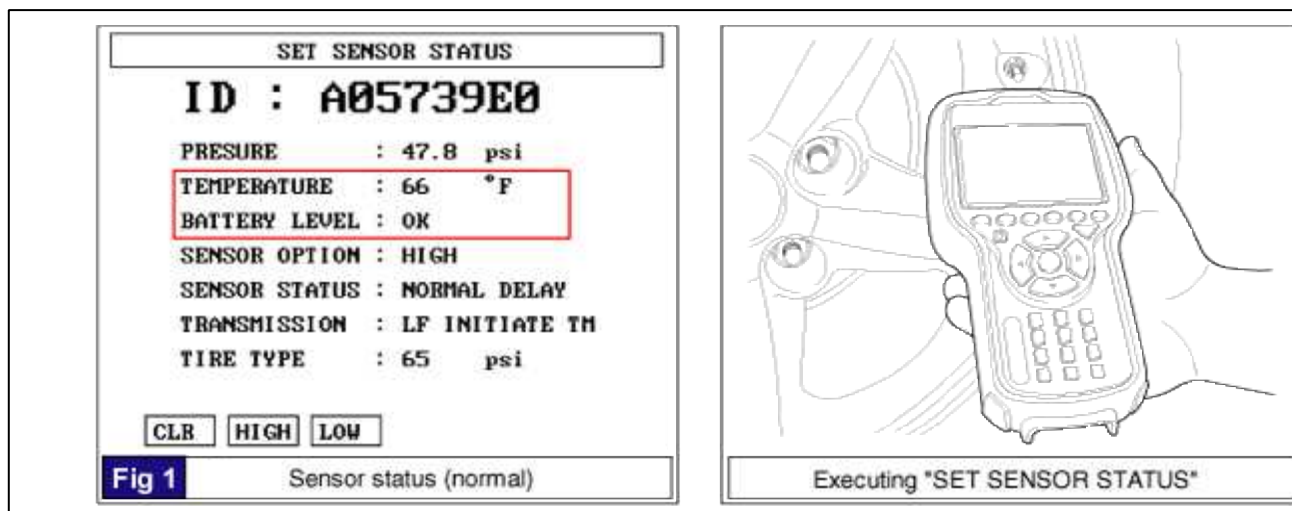
### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	<ul style="list-style-type: none"> <li>Internal RF circuit check of Receiver module</li> </ul>	<ul style="list-style-type: none"> <li>Faulty TPMS Receiver module</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>No valid RF data for 12 min from any sensor</li> <li>RF messages and the signal levels are unexpected</li> </ul>	
Threshold value	<ul style="list-style-type: none"> <li>Internal RF circuit fault</li> </ul>	
Diagnosis time	<ul style="list-style-type: none"> <li>12 ~13 minutes</li> </ul>	

## Component Inspection

Check status of all TPM sensor

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.  
Execute "SET SENSOR STATUS" of each wheel.



3. Are status of all sensors "normal"?

**YES**

Check TPM receiver RF shielding.

If it is OK, go to "Check TPM receiver" as follows.

Repair if necessary and go to "Verification of Vehicle Repair" procedure.

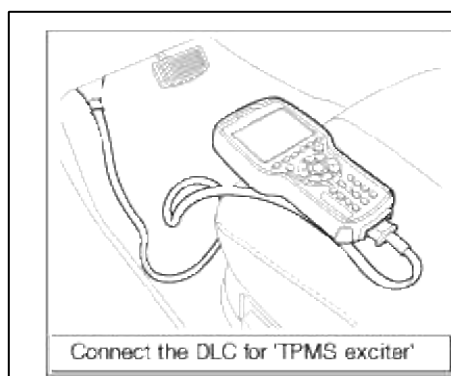
**NO**

Change status of all TPM sensors into "normal" status with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

Check TPM receiver

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1660' present ?

**YES**

Substitute with a known-good TPM Receiver module and check for proper operation.

If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

**NO**

TPM receiver complete successful Auto-Learn.

System is OK.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

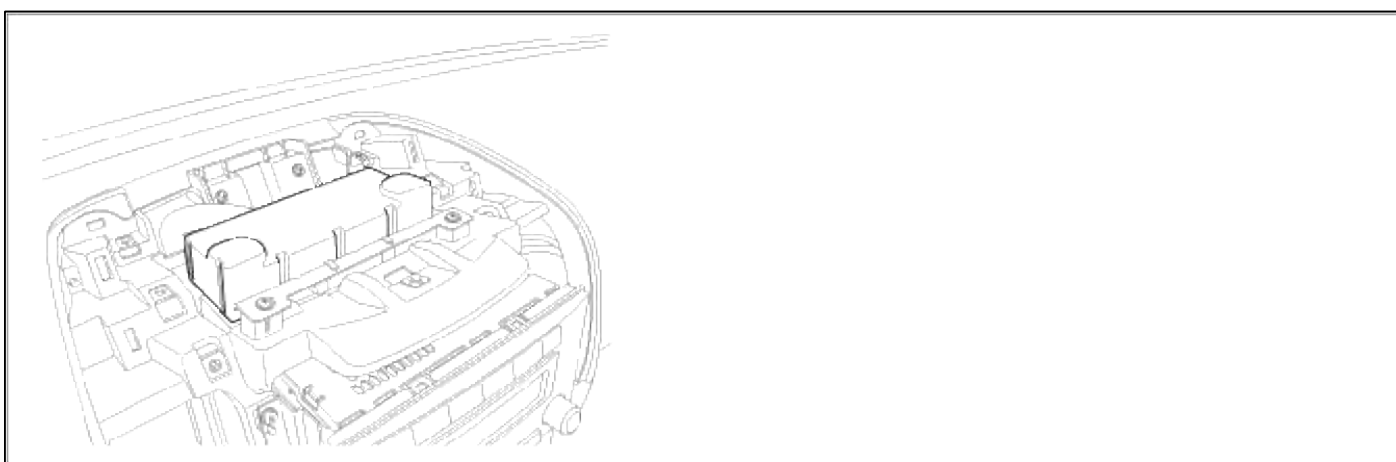
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1661

### Component Location



### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

### DTC Description

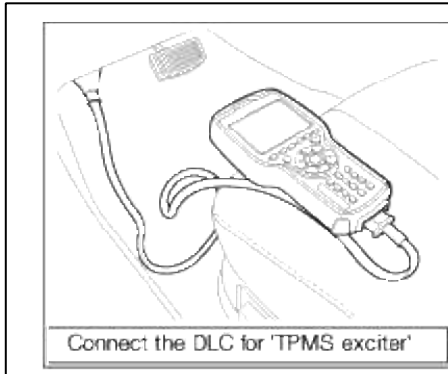
This DTC indicates that the receiver has a problem reading or writing to EEPROM.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Receiver module check	<ul style="list-style-type: none"> <li>• Transient over voltage due to vehicle fault (fault would typically recover)</li> <li>• Faulty TPMS Receiver</li> </ul>
Enable conditions	• Reading or writing problem to EEPROM	
Threshold value	• EEPROM in the receiver module fault	
Diagnosis time	• < 10 sec.	

## Component Inspection

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1661' present ?

**YES**

Substitute with a known-good TPM Receiver module and check for proper operation.

If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

**NO**

TPM receiver complete successful Auto-Learn.  
System is OK.

## Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

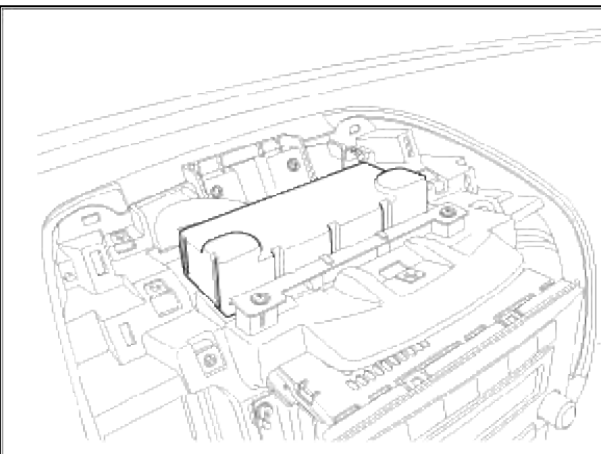
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1664

### Component Location





### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

### DTC Description

This DTC indicates that the receiver has not received any RF messages. The most likely cause is receiver module failure.

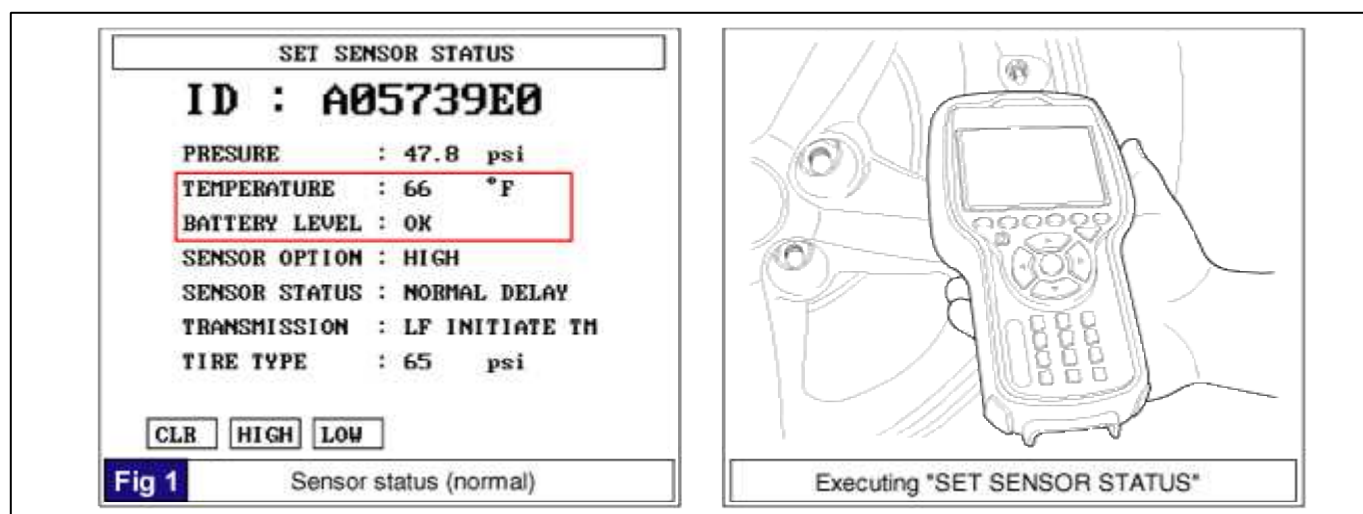
### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• LF/ RF check	<ul style="list-style-type: none"> <li>• Faulty TPMS receiver</li> <li>• Faulty harness/ Open circuit connection of common initiator supply</li> <li>• No initiator connected</li> <li>• All sensors incorrectly configured as Low line</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• Not able to any sensors</li> <li>• 4km &lt; Distance traveled during 12min. &lt; 40km</li> </ul>	
Threshold value	• TPMS receiver module fault	
Diagnosis time	• 12~13 minutes	

### Component Inspection

Check status of all TPM sensor

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.  
Execute "SET SENSOR STATUS" of each wheel.



3. Are status of all sensors "normal"?

**YES**

Check TPM receiver RF shielding.

If it is OK, go to "Check TPM receiver" as follows.

Repair if necessary and go to "Verification of Vehicle Repair" procedure.

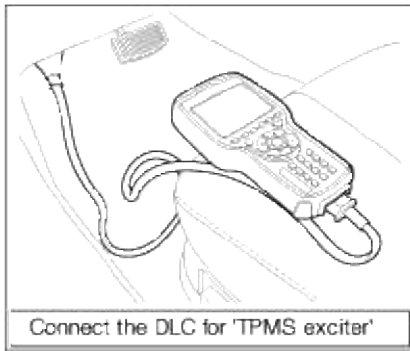
**NO**

Change status of all TPM sensors into "normal" status with 'TPMS exciter'.

Go to "Verification of Vehicle Repair" procedure.

Check TPM receiver

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Clear DTC.

3. IG OFF & IG ON. Wait 4 minutes.

4. Execute "Diagnostic Trouble Codes(DTCs)".

5. Is 'C1664' present ?

**YES**

Substitute with a known-good TPM Receiver module and check for proper operation.

If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

**NO**

TPM receiver complete successful Auto-Learn.

System is OK.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode

2. Using a TPMS exciter or scantool, Clear DTC.

3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

**YES**

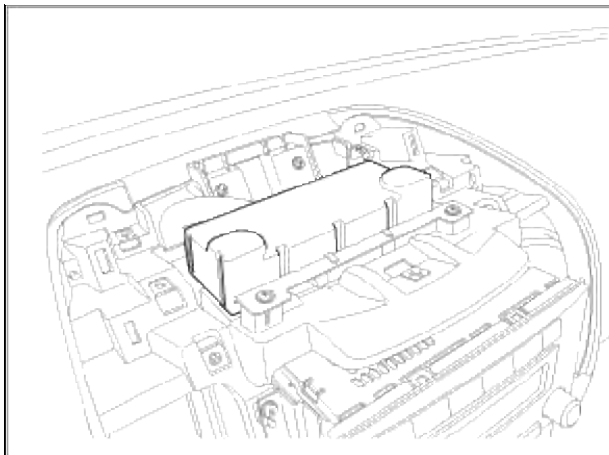
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C1665

Component Location



### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

### DTC Description

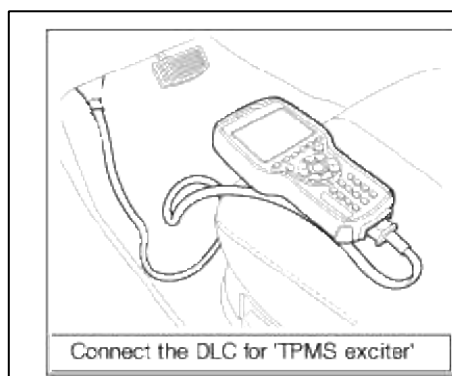
This DTC indicates that ECU detects short circuit with supply FET off (12V short) or ECU detects short circuit with supply FET on (0V short).

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Power supply circuit from Receiver check	<ul style="list-style-type: none"> <li>• Short circuit to GND between Receiver and Initiator</li> <li>• Short circuit to 12V between Receiver and Initiator</li> </ul>
Enable conditions	<ul style="list-style-type: none"> <li>• Power supply circuit from Receiver short to GND</li> <li>• Power supply circuit from Receiver short to 12V</li> </ul>	
Threshold value	• Common supply output from receiver low when on.	
Diagnosis time	• < 10s	

### Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect the 'TPMS exciter' or scan tool to Data Link Connector (DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select "FULL" mode of "CURRENT DATA" function.

5. Monitor the parameter of sensor on the 'TPMS exciter' or scan tool after 13minutes.

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	V	S3 TEMP.	71	°F
BATT.VOLT	14.0	V	S3 TRANS.	TIMED	
S1 PRESS.	33	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	71	°F	S4 PRESS.	34	psi
S1 TRANS.	TIMED		S4 TEMP.	71	°F
S1 BAT.LVL	NORMAL		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 1**      Sensor current data (normal)

1.2 CURRENT DATA					
SPEED	0	MPH	S3 PRESS.	31	psi
RF RSSI B	1.4	V	S3 TEMP.	71	°F
BATT.VOLT	14.0	V	S3 TRANS.	TIMED	
S1 PRESS.	----	psi	S3 BAT.LVL	NORMAL	
S1 TEMP.	----	°F	S4 PRESS.	34	psi
S1 TRANS.	UNKNOWN		S4 TEMP.	71	°F
S1 BAT.LVL	UNKNOWN		S4 TRANS.	TIMED	
S2 PRESS.	30	psi	S4 BAT.LVL	NORMAL	
S2 TEMP.	71	°F			
S2 TRANS.	TIMED				
S2 BAT.LVL	NORMAL				

**Fig 2**      Sensor current data (failure)

**Fig 1** Sensor current data (normal)

**Fig 2** Sensor current data (failure)

6. Is parameter normal?

**YES**

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.  
Go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Inspection/ Repair" procedure.

#### Terminal and Connector Inspection

- Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
- Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

If it is 'Open in signal/ ground', go to "Check Open" of "Signal Circuit Inspection" procedure.

If it is 'short to battery in signal', go to "Check Short to battery" of "Signal Circuit Inspection" procedure.

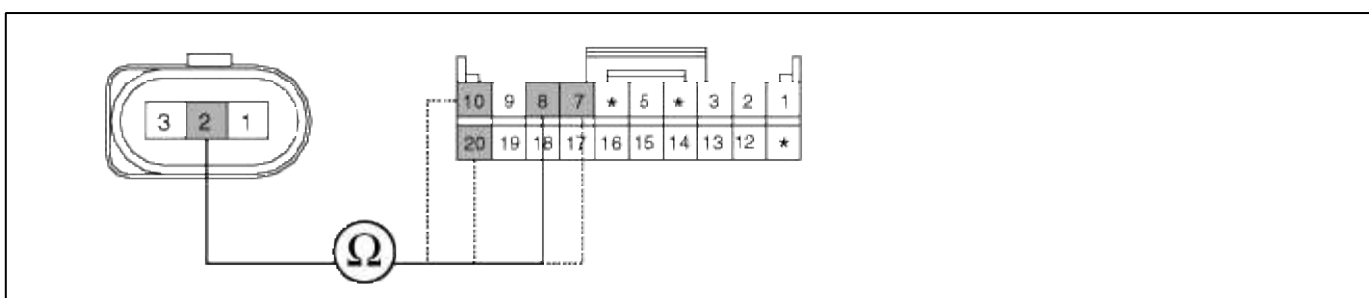
If it is 'Short to ground in signal', go to "Check Short to ground" of "Signal Circuit Inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION

##### [CHECK OPEN]

- Ignition "OFF"
- Disconnect FL/FR/RL/RR initiator connector and TPMS receiver connector.
- Measure resistance between terminal "2" of FL/FR/RL/RR initiator harness connector and terminal "8 (FL), 10 (F 7 (RL), 20 (RR)" of TPMS receiver connector.

Specification: Approx. 0Ω



4. Is the measured resistance within specifications?

**YES**

Go to "Ground Circuit Inspection" procedure.

**NO**

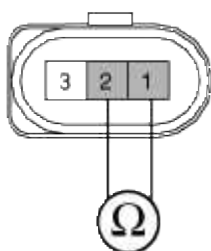
Check for open in signal harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

[CHECK SHORT TO BATTERY]

1. Ignition "OFF"
2. Disconnect all initiator connector (FL/FR/RL/RR) and TPMS receiver connector.
3. Measure resistance between terminal "2" and terminal "1" of each initiator harness connector.

Specification:  $\infty$



4. Is the measured resistance within specifications?

**YES**

Go to "5." as follows.

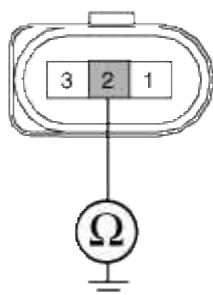
**NO**

Check for short to battery in signal harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

5. Ignition "ON"
6. Measure voltage between terminal "2" each initiator harness connector and chassis ground.

Specification: Approx. 0V



7. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

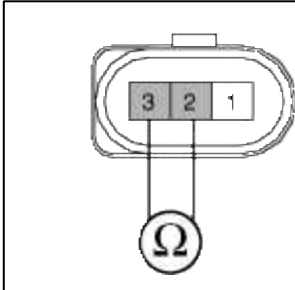
**NO**

Check for short to battery in signal harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

[CHECK SHORT TO GROUND]

1. Ignition "OFF"
2. Disconnect FL/FR/RL/RR initiator connector and TPMS receiver connector.
3. Measure resistance between terminal "2" and terminal "3" of FL/FR/RL/RR initiator harness connector.



4. Is the measured resistance within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

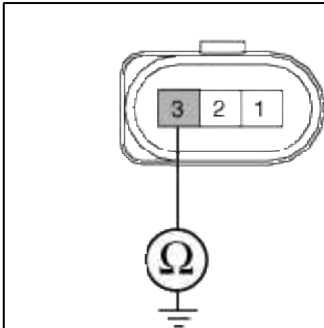
Check for short to ground in signal harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

#### GROUND CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect FL/FR/RL/RR initiator connector and TPMS receiver connector.
3. Measure resistance between terminal "3" of FL/FR/RL/RR initiator harness connector and chassis ground.

Specification: Approx. 0Ω



4. Is the measured resistance within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for open in ground harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

**YES**

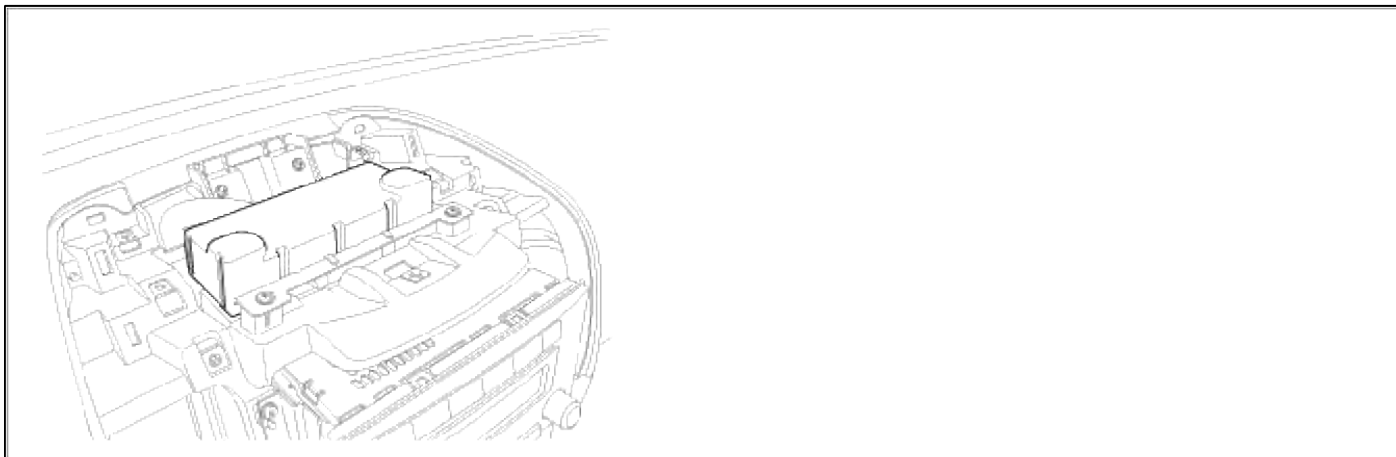
Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Suspension System > Troubleshooting > C1668

#### Component Location



#### General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

#### DTC Description

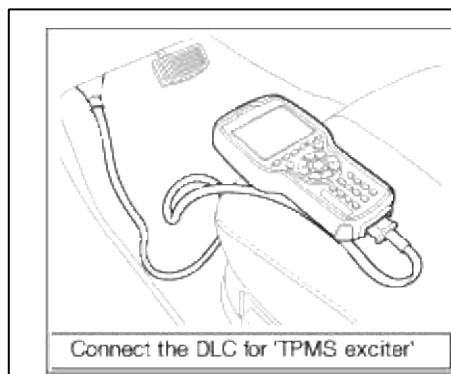
This DTC indicates that the receiver has detected an internal error.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Receiver module check	<ul style="list-style-type: none"> <li>• Transient over voltage due to vehicle fault (fault would typically recover)</li> <li>• Faulty TPMS Receiver</li> </ul>
Enable conditions	• An Internal error	
Threshold value	• TPMS Receiver module fault	
Diagnosis time	• < 3 sec. - Carried out once at Ignition ON	

#### Component Inspection

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1668' present ?

**YES**

Substitute with a known-good TPM Receiver module and check for proper operation.

If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

**NO**

TPM receiver complete successful Auto-Learn.  
System is OK.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C2510

### Component Location



### General Description

The TPMS receiver unit must provide outputs continuously to drive the indicator lamps. The TREAD/ wheel



location indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The TPMS warning indicator lamp on when the TPMS receiver unit has detected a system fault.

#### DTC Description

This DTC indicates that the TREAD/ Wheel location/ DTC warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness/ digital clock(warning lamp) module/ connector/ receiver short circuit.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp/ LED current check	• Short circuit to 12V between lamp and TPMS receiver
Enable conditions	• TREAD/ Diagnostic lamp/ LED circuit short to 12V	
Threshold value	• TREAD/ Diagnostic lamp 200mA allowed each (after in rush time).	
Diagnosis time	• LED's - 30mA allowed each. 50mA margin built in. Diagnosis time • < 3s	

#### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

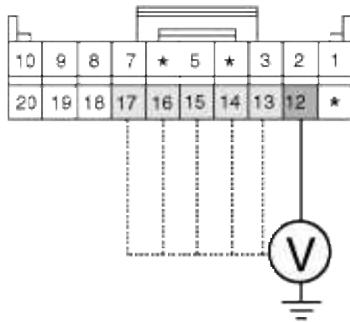
Go to "Charging System Inspection" procedure..

#### Control Circuit Inspection

1. Engine "OFF"
2. Disconnect digital clock(warning lamp) module connector and TPMS receiver connector.
3. Engine "ON"

4. Measure voltage between terminal "12 (RR LED)/13 (FR LED)/14 (RL LED)/15 (FL LED)/16 (TREAD)/17 (TPMS)" of TPMS receiver harness connector and chassis ground.

Specifications: 0V



5. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for short to power in control harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

#### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

### Suspension System > Troubleshooting > C2511

#### Component Location



#### General Description

The TPMS receiver unit must provide outputs continuously to drive the indicator lamps. The TREAD/ wheel

location indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The TPMS warning indicator lamp on when the TPMS receiver unit has detected a system fault.

#### DTC Description

This DTC indicates that the TREAD/ Wheel location/ DTC warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness/ digital clock(warning lamp) module/ connector/ receiver short circuit.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp/ LED current check	• Short circuit to 12V between lamp and TPMS receiver
Enable conditions	• TREAD/ Diagnostic lamp/ LED circuit short to 12V	
Threshold value	• TREAD/ Diagnostic lamp 200mA allowed each (after in rush time).	
Diagnosis time	• LED's - 30mA allowed each. 50mA margin built in. Diagnosis time • < 3s	

#### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

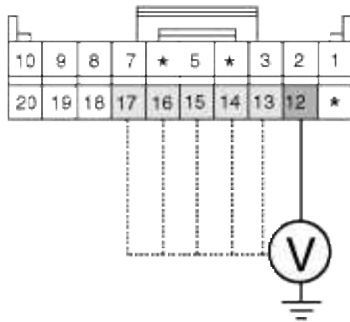
Go to "Charging System Inspection" procedure..

#### Control Circuit Inspection

1. Engine "OFF"
2. Disconnect digital clock(warning lamp) module connector and TPMS receiver connector.
3. Engine "ON"

4. Measure voltage between terminal "12 (RR LED)/13 (FR LED)/14 (RL LED)/15 (FL LED)/16 (TREAD)/17 (TPMS)" of TPMS receiver harness connector and chassis ground.

Specifications: 0V



5. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for short to power in control harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C2512

### Component Location



### General Description

The TPMS receiver unit must provide outputs continuously to drive the indicator lamps. The TREAD/ wheel

location indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The TPMS warning indicator lamp on when the TPMS receiver unit has detected a system fault.

#### DTC Description

This DTC indicates that the TREAD/ Wheel location/ DTC warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness/ digital clock(warning lamp) module/ connector/ receiver short circuit.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp/ LED current check	• Short circuit to 12V between lamp and TPMS receiver
Enable conditions	• TREAD/ Diagnostic lamp/ LED circuit short to 12V	
Threshold value	• TREAD/ Diagnostic lamp 200mA allowed each (after in rush time).	
Diagnosis time	• LED's - 30mA allowed each. 50mA margin built in. Diagnosis time • < 3s	

#### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

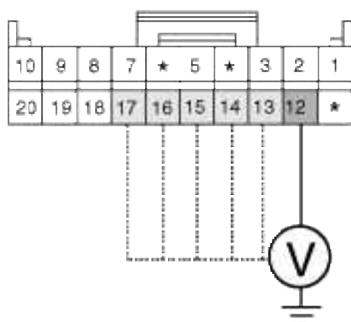
Go to "Charging System Inspection" procedure..

#### Control Circuit Inspection

1. Engine "OFF"
2. Disconnect digital clock(warning lamp) module connector and TPMS receiver connector.
3. Engine "ON"

4. Measure voltage between terminal "12 (RR LED)/13 (FR LED)/14 (RL LED)/15 (FL LED)/16 (TREAD)/17 (TPMS)" of TPMS receiver harness connector and chassis ground.

Specifications: 0V



5. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for short to power in control harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C2513

### Component Location



### General Description

The TPMS receiver unit must provide outputs continuously to drive the indicator lamps. The TREAD/ wheel

location indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The TPMS warning indicator lamp on when the TPMS receiver unit has detected a system fault.

#### DTC Description

This DTC indicates that the TREAD/ Wheel location/ DTC warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness/ digital clock(warning lamp) module/ connector/ receiver short circuit.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp/ LED current check	• Short circuit to 12V between lamp and TPMS receiver
Enable conditions	• TREAD/ Diagnostic lamp/ LED circuit short to 12V	
Threshold value	• TREAD/ Diagnostic lamp 200mA allowed each (after in rush time).	
Diagnosis time	• LED's - 30mA allowed each. 50mA margin built in. Diagnosis time • < 3s	

#### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

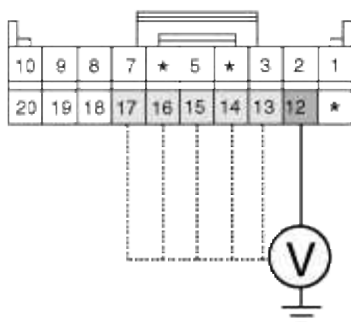
Go to "Charging System Inspection" procedure..

#### Control Circuit Inspection

1. Engine "OFF"
2. Disconnect digital clock(warning lamp) module connector and TPMS receiver connector.
3. Engine "ON"

4. Measure voltage between terminal "12 (RR LED)/13 (FR LED)/14 (RL LED)/15 (FL LED)/16 (TREAD)/17 (TPMS)" of TPMS receiver harness connector and chassis ground.

Specifications: 0V



5. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for short to power in control harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C2514

### Component Location



### General Description

The TPMS receiver unit must provide outputs continuously to drive the indicator lamps. The TREAD/ wheel



location indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The TPMS warning indicator lamp on when the TPMS receiver unit has detected a system fault.

#### DTC Description

This DTC indicates that the TREAD/ Wheel location/ DTC warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness/ digital clock(warning lamp) module/ connector/ receiver short circuit.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp/ LED current check	• Short circuit to 12V between lamp and TPMS receiver
Enable conditions	• TREAD/ Diagnostic lamp/ LED circuit short to 12V	
Threshold value	• TREAD/ Diagnostic lamp 200mA allowed each (after in rush time).	
Diagnosis time	• LED's - 30mA allowed each. 50mA margin built in. Diagnosis time • < 3s	

#### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

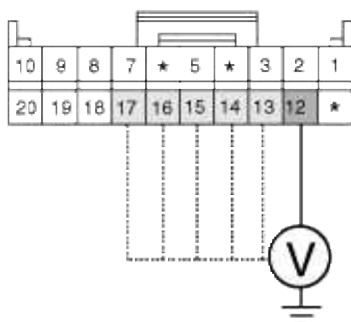
Go to "Charging System Inspection" procedure..

#### Control Circuit Inspection

1. Engine "OFF"
2. Disconnect digital clock(warning lamp) module connector and TPMS receiver connector.
3. Engine "ON"

4. Measure voltage between terminal "12 (RR LED)/13 (FR LED)/14 (RL LED)/15 (FL LED)/16 (TREAD)/17 (TPMS)" of TPMS receiver harness connector and chassis ground.

Specifications: 0V



5. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for short to power in control harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System performing to specification at this time.

## Suspension System > Troubleshooting > C2515

### Component Location



### General Description

The TPMS receiver unit must provide outputs continuously to drive the indicator lamps. The TREAD/ wheel

location indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The TPMS warning indicator lamp on when the TPMS receiver unit has detected a system fault.

#### DTC Description

This DTC indicates that the TREAD/ Wheel location/ DTC warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness/ digital clock(warning lamp) module/ connector/ receiver short circuit.

#### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp/ LED current check	• Short circuit to 12V between lamp and TPMS receiver
Enable conditions	• TREAD/ Diagnostic lamp/ LED circuit short to 12V	
Threshold value	• TREAD/ Diagnostic lamp 200mA allowed each (after in rush time).	
Diagnosis time	• LED's - 30mA allowed each. 50mA margin built in. Diagnosis time • < 3s	

#### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

**YES**

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

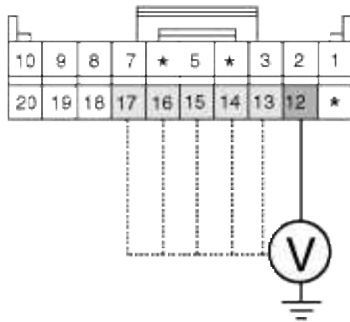
Go to "Charging System Inspection" procedure..

#### Control Circuit Inspection

1. Engine "OFF"
2. Disconnect digital clock(warning lamp) module connector and TPMS receiver connector.
3. Engine "ON"

4. Measure voltage between terminal "12 (RR LED)/13 (FR LED)/14 (RL LED)/15 (FL LED)/16 (TREAD)/17 (TPMS)" of TPMS receiver harness connector and chassis ground.

Specifications: 0V



5. Is the measured voltage within specifications?

**YES**

Substitute with a known-good TPMS receiver and check for proper operation.

If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for short to power in control harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

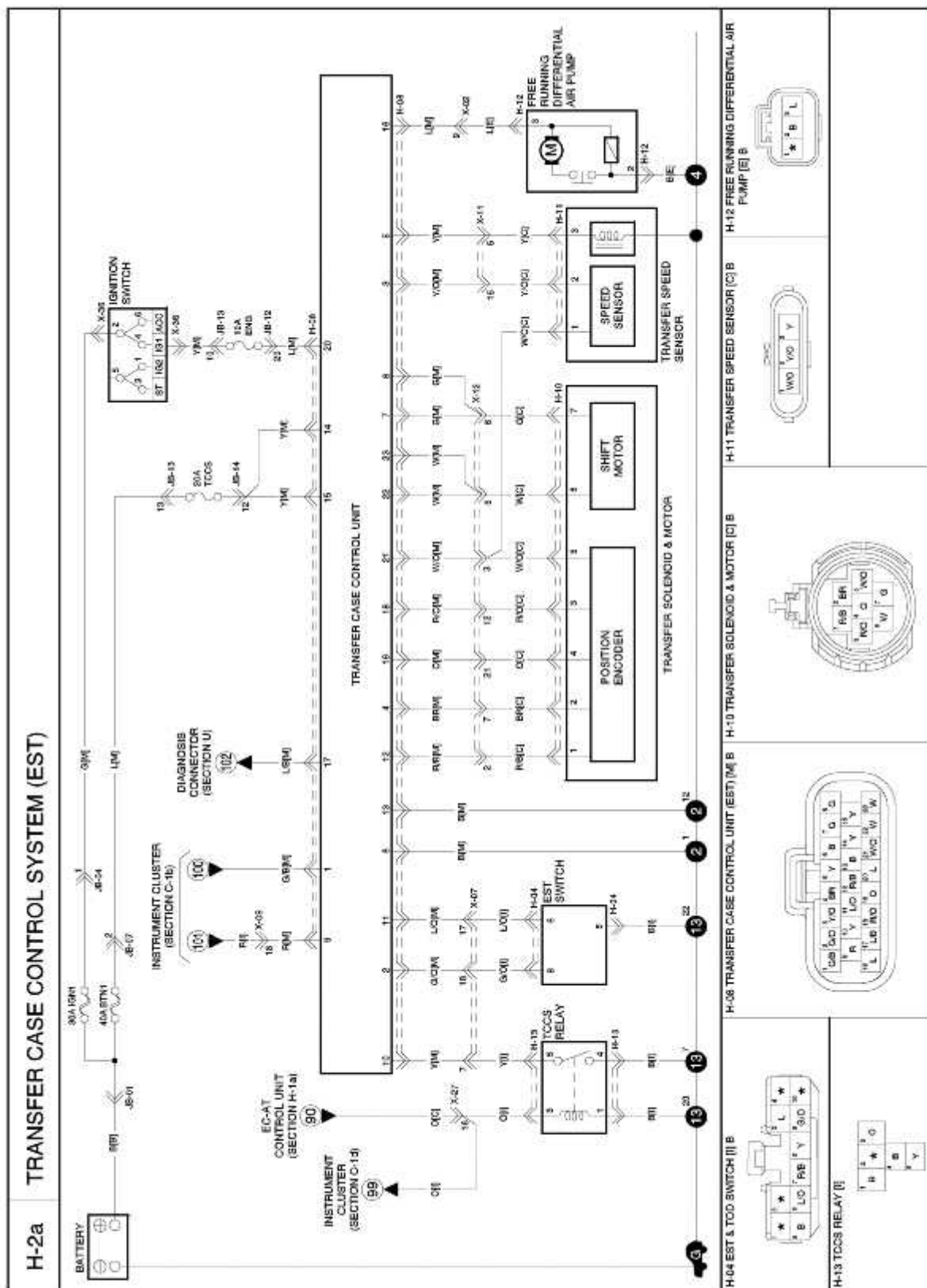
System performing to specification at this time.

# SORENTO(BL) > 2007 > G 3.3 DOHC > Transfer System

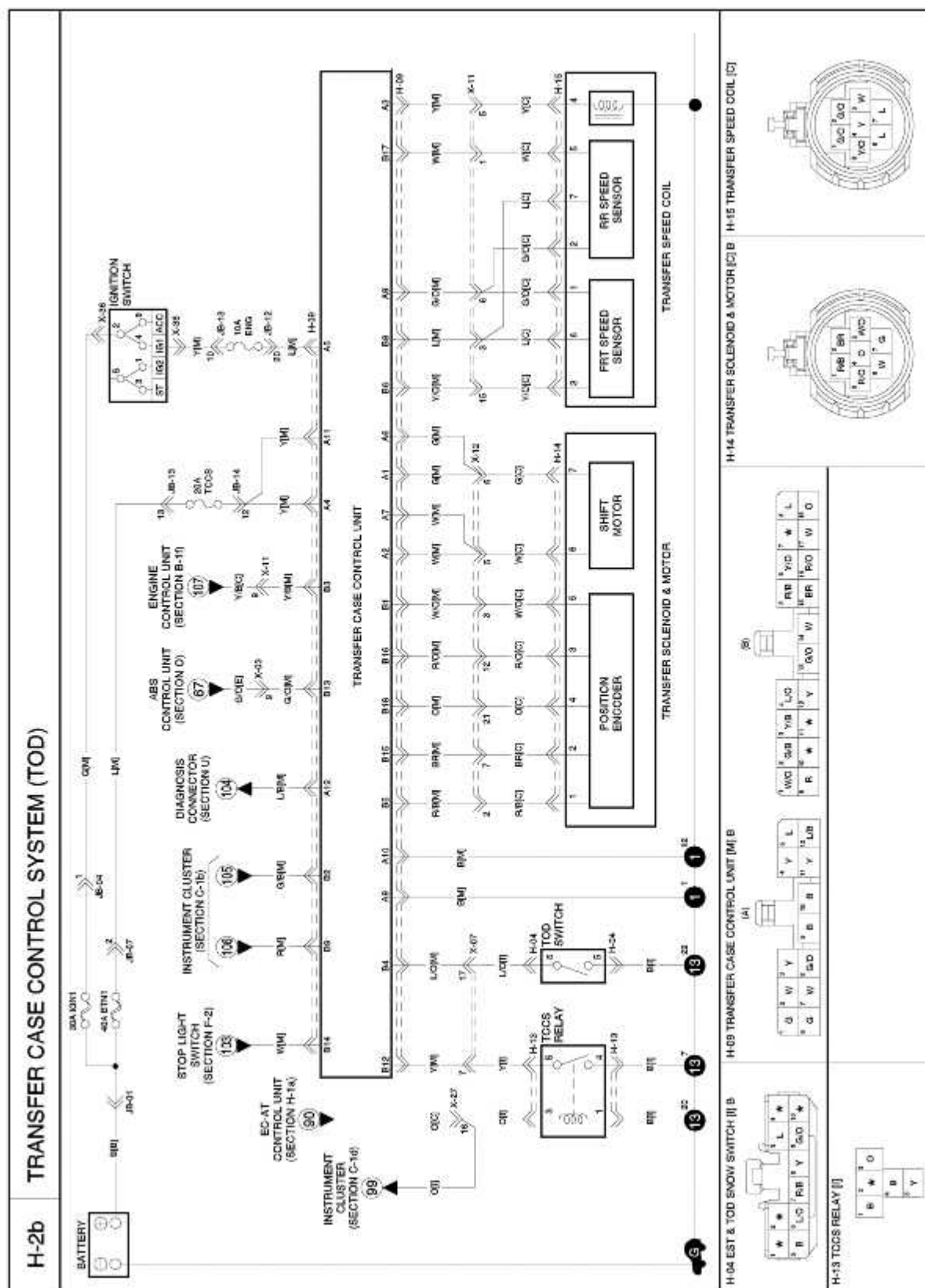
## Transfer System > Transfer Case Assembly > Schematic Diagrams (M5UR1)

TCCM

EST Circuit diagram (1)



ATT(or TOD) Circuit diagram (2)



## Transfer System > Transfer Case Assembly > Description and Operation (M5UR1)

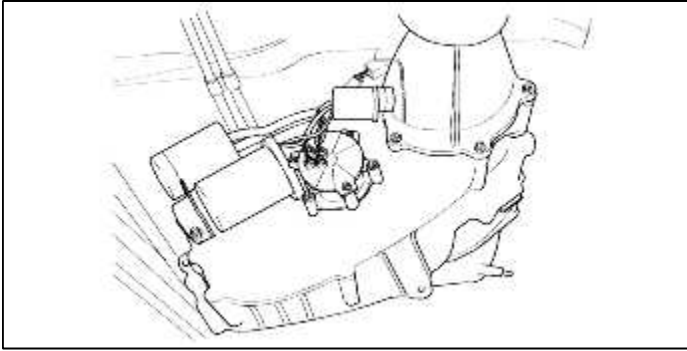
EST (ELECTRONIC SHIFT TRANSFER)

## INTRODUCTION

EXT system is a kind of part time 4 wheel drive system and its full name is "Electronic shift transfer". Instead of

previous free wheel hub, FRRD (Free Running Differential) was adopted and this one is for SOTF (shift on the fly) while vehicle driving. When the vehicle runs with 2WD again, the front axle will be rotated idly due to the vehicle speed and this makes the noise and vibration on the propeller shaft and ring gear set. Therefore FRRD will prevent these phenomena to get a driving stability, efficiency and improved NVH.

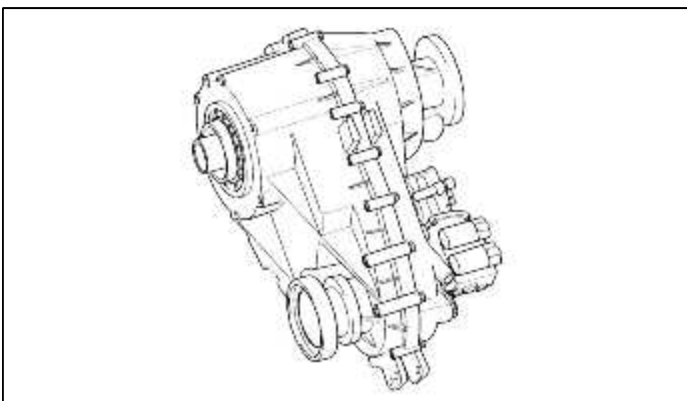
When 4WD is selected by driver, a FRRD air pump motor operates and a dog clutch in FRRD is engaged to pinion shaft making s front wheels drive. Therefore the front propeller shaft and the front drive shaft are coupled rotating together. Oppositely, if 2WD is selected by a driver, the dog clutch in a FRRD is disengaged resulting in disconnection between the front propeller shaft and the front drive shaft.



## TOD (TORQUE ON DEMAND) OR ATT (ACTIVE TORQUE TRANSFER)

### INTRODUCTION

TOD system is a kind of full time 4 wheel drive system and its full name is "Torque on demand". The optimum engine torque distribution ratio between front and rear is controlled by TOD transfer case. This transfer case is controlled and operated by independent control module, that is TCCM (Transfer case control module) and it is located under the crash pad on passenger side.



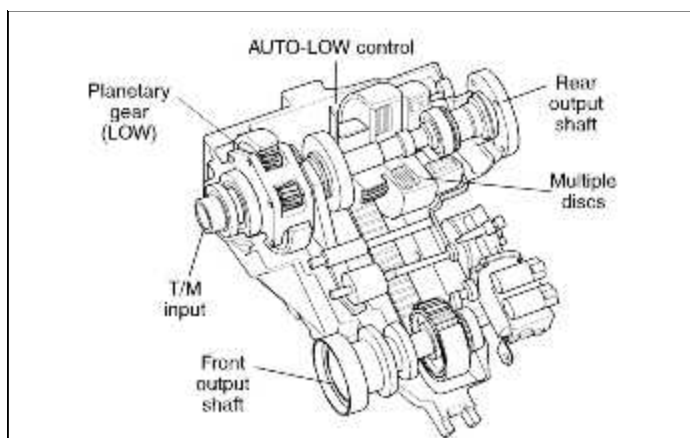
The torque transmission ratio to front and rear side is not fixed and it is changed and controlled continuously depends on the road and vehicle driving condition.

Basically the torque split ratio will be 0:100 (that is "FR" situation) on road driving with low and medium vehicle speed. If there is any amount of slip on the rear wheel, the optimum amount of torque will be distributed to front wheel to get a stable driving performance.

The range of torque split ratio is from 0:100 to 50:50. It means the maximum torque amount of front wheel cannot be higher than rear wheel in any kind of road or vehicle condition.

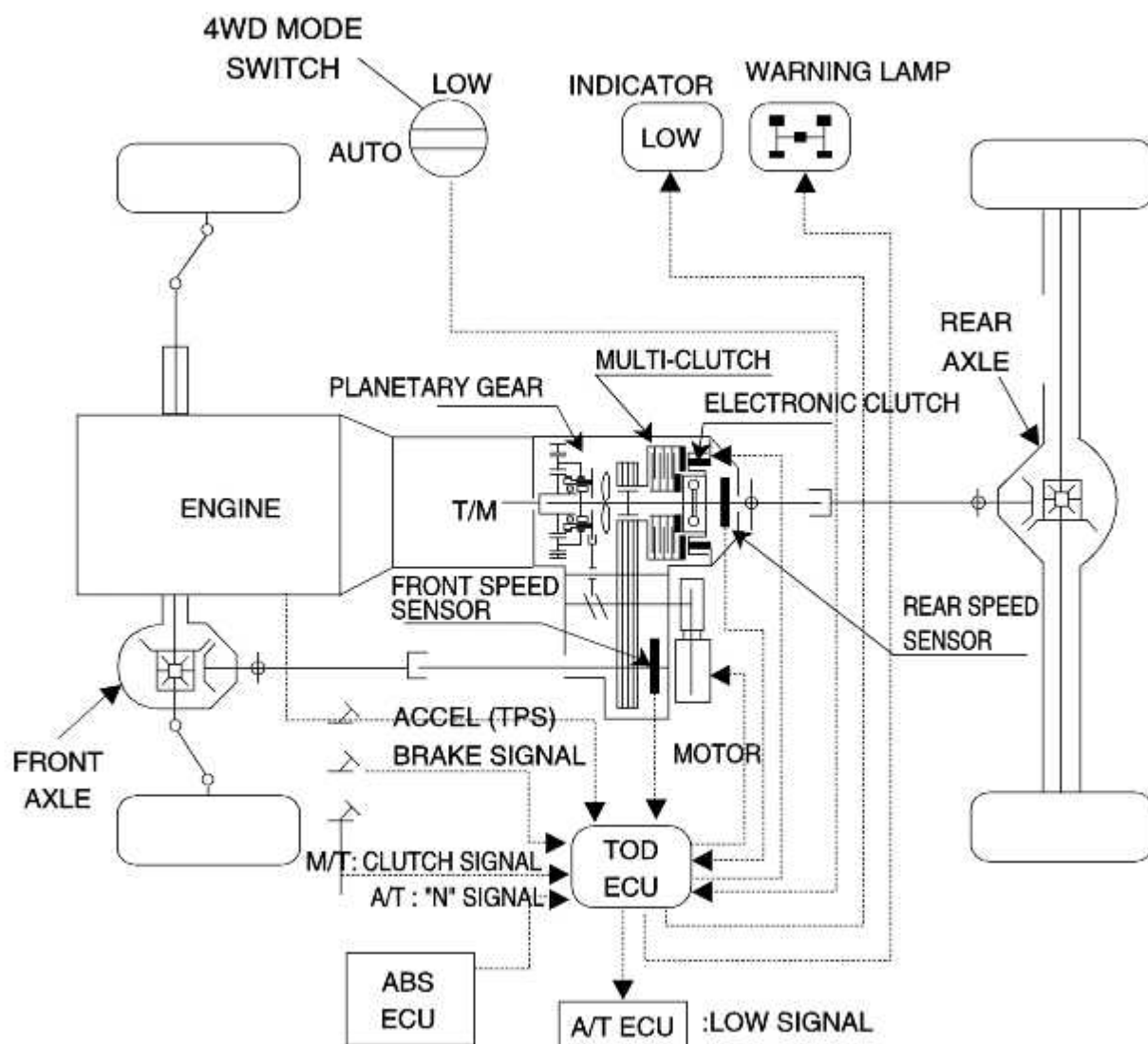
According to the speed signal of front and rear wheel from each sensor, the engine torque information from engine ECM, EMC (Electro magnetic clutch) will be activated and it will result the change of depressing force to the multiple disc clutch. If the force is high, more engine torque will be transmitted to front wheel.

Oppositely, if it becomes low, the torque to front side also will be decreased. It means the slip inside of multiple disc clutch will be increased also. Therefore the oil pump for lubrication of clutch is installed and very important for the overall system durability.



## SYSTEM DIAGRAM

### ACTIVE TORQUE TRANSFER (ATT)

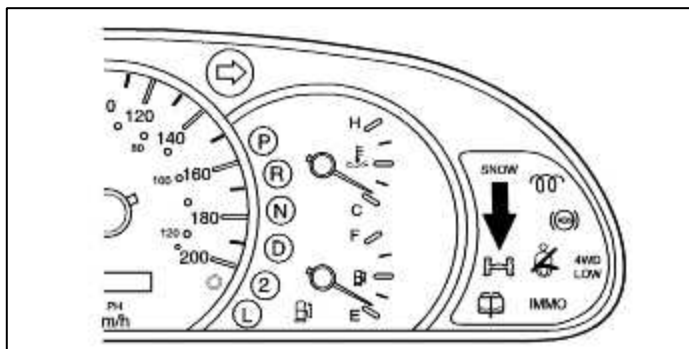




## Transfer System > Transfer Case Assembly > Troubleshooting (M5UR1)

### ELECTRIC SHIFT TRANSFER

1. If a malfunction occurs, the 4WD indicator lamp will blink to warn the driver.



2. Following items will be indicated

- (1) TCCM
- (2) Shift motor
- (3) Magnetic synchronizer clutch
- (4) Speed sensor
- (5) Hub solenoid
- (6) Selector switch
- (7) Motor position sensor

3. DTC Table

Code	Item
001	TCCM
010	Shift motor
011	Synchronizer
100	clutch
101	Speed sensor
110	Hub solenoid
111	Selector switch
	Motor position sensor

4. DTC Indication

- (1) Indicator lamp check (0.6S)
- (2) Lamp OFF (3S)
- (3) DTC Indication
- (4) OFF (3S)
- (5) Repeat steps 3), 4)
- (6) Repeat steps 3), 4), 5) for additional faults.

5. Meaning of code

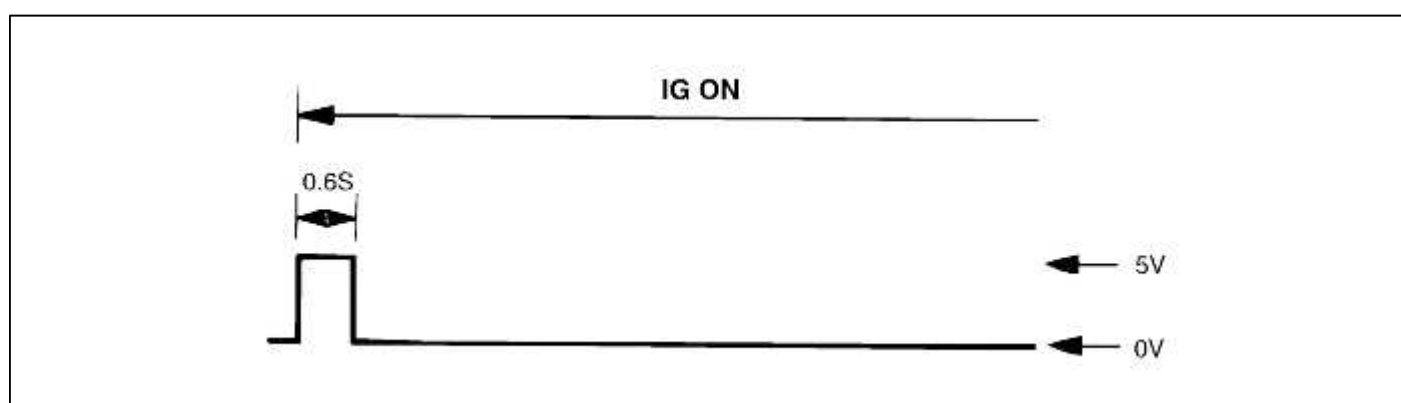
- 0 : Lamp ON for 0.5 second
- 1 : Lamp ON for 1 second

## 6. EX) TCCM Fault (DTC : 001)

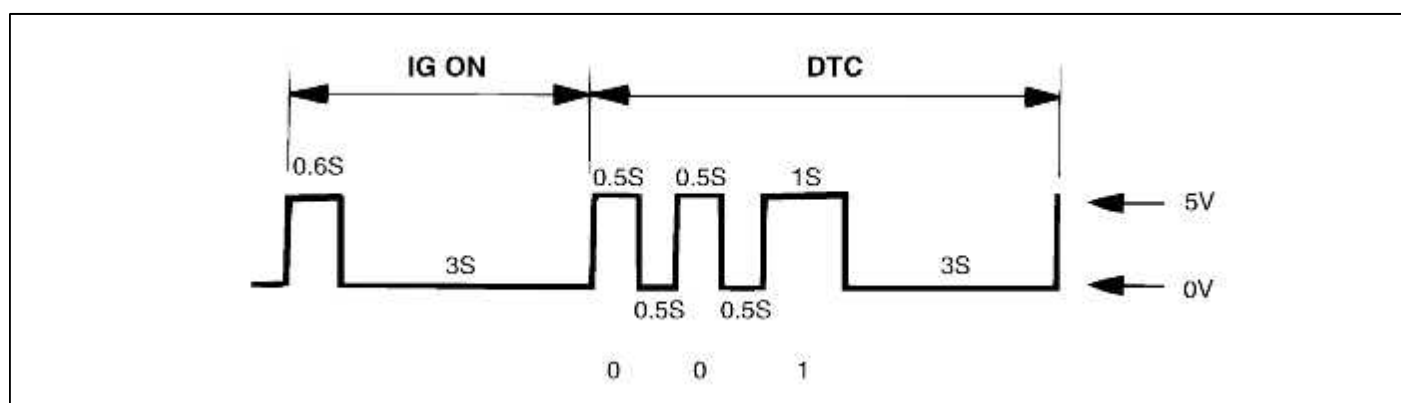
- (1) Indicator lamp check (0.6S)
- (2) Lamp OFF (3S)
- (3) Lamp ON (0.5S)
- (4) Lamp OFF (0.5S)
- (5) Lamp ON (0.5S)
- (6) Lamp OFF (0.5S)
- (7) Lamp ON (1S)
- (8) Lamp OFF (3S)
- (9) Repeat steps 3) - 8).

## READING METHOD

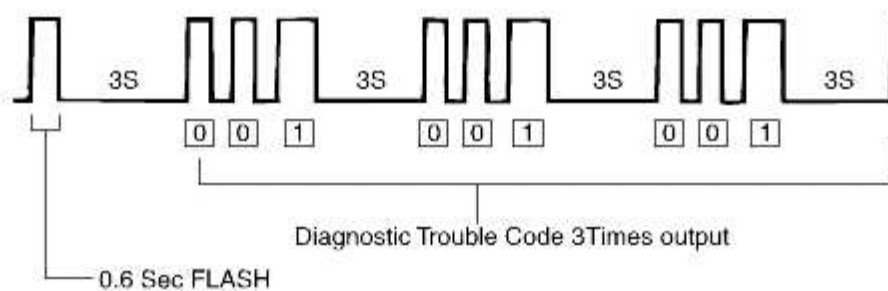
Normal



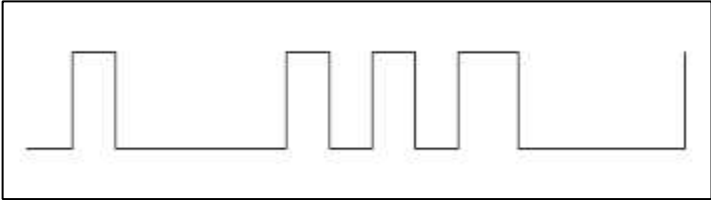
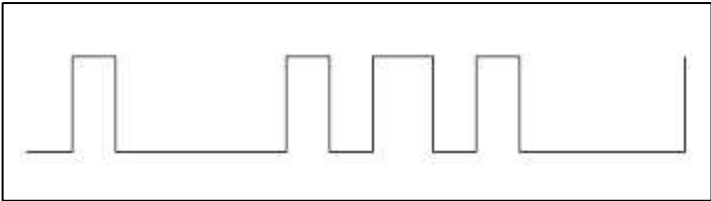
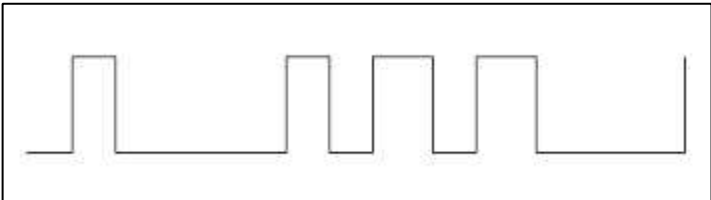
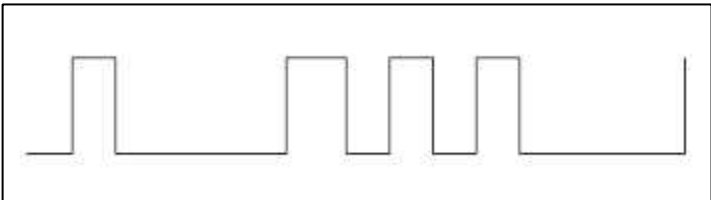
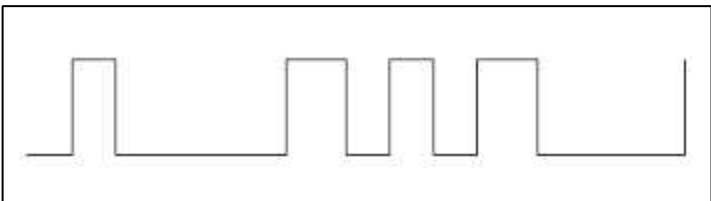
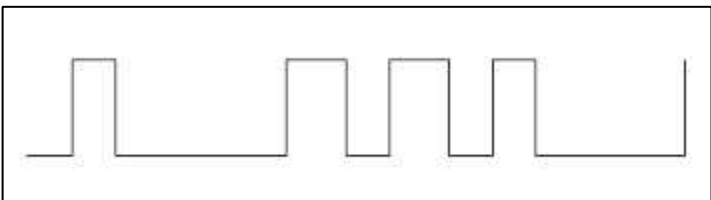
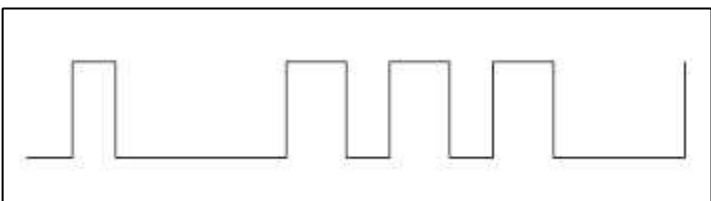
Fault



## [Example]



## DTC PATTERN

Code	Output pattern	Item
001		TCCM
010		Shift motor
011		Magnetic synchronizer clutch
100		Speed sensor
101		Hub solenoid valve
110		Select switch
111		Motor position sensor

ACTIVE TORQUE TRANSFER (TOD)

<b>DTC</b>	<b>Content</b>
P1725	TOD CONTROL MODULE(CHECKSUM) ERROR
P1726	THROTTLE POSITION INPUT - LOSS OF SIGNAL
P1727	THROTTLE POSITION INPUT - OUT OF RANGE
P1728	EMC - OPEN/SHORT TO BATTERY
P1729	EMC - SHORT TO GROUND
P1730	FRONT SPEED SENSOR - LOW INPUT
P1731	FRONT SPEED SENSOR - HIGH INPUT
P1732	REAR SPEED SENSOR - LOW INPUT
P1733	REAR SPEED SPEED SENSOR - HIGH INPUT
P1734	SPEED SENSOR REFERENCE - LOW INPUT
P1735	SPEED SENSOR REFERENCE - HIGH INPUT
P1736	SHIFT MOTOR - OPEN
P1737	SHIFT MOTOR - OPEN/SHORT TO GROUND
P1738	SHIFT SYSTEM TIMEOUT
P1739	GENERAL POSITION ENCODER FAULT
P1740	POSITION 1 - SHORT TO GROUND
P1741	POSITION 2 - SHORT TO GROUND
P1742	POSITION 3 - SHORT TO GROUND
P1743	POSITION 4 - SHORT TO GROUND

### **DTC Memory Erase**

DTC memory in case of the Active Torque Transfer type is erased by the Hi-Scan.

#### **SELF-DIAGNOSIS PROCEDURE FOR EST(MANUAL)**

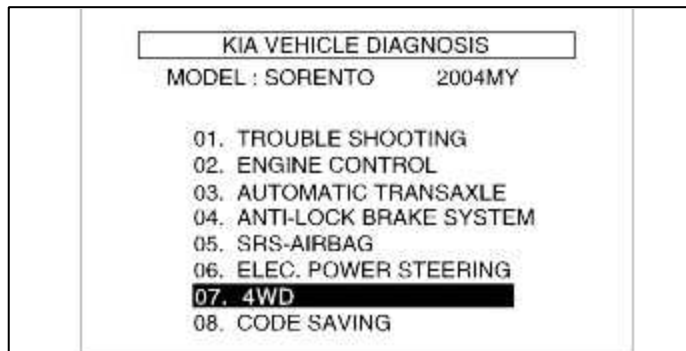
1. Connect a Hi-scan to the self-diagnosis connector on the engine room OBD connector. (the lower inside of crash pad in driver's side)
2. Turn the ignition ON.

3. Select and operate according to the instructions on the Hi-scan screen.

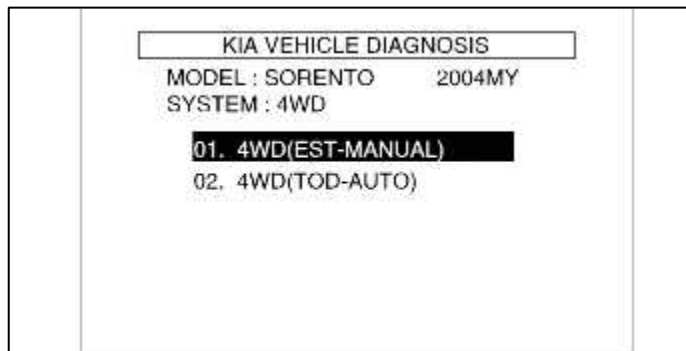
(1) Select "KIA VEHICLE DIAGNOSIS".

(2) Select "VEHICLE NAME".

(3) Select "4WD SYSTEM".

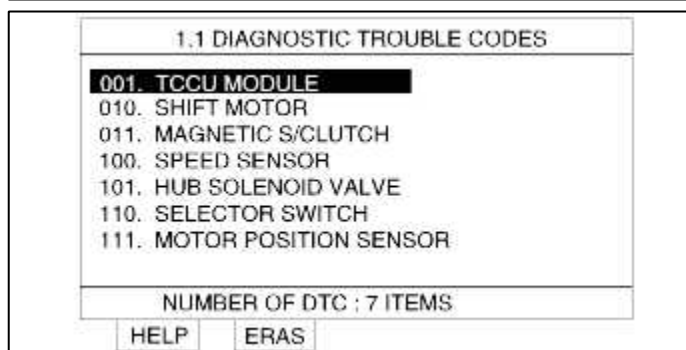
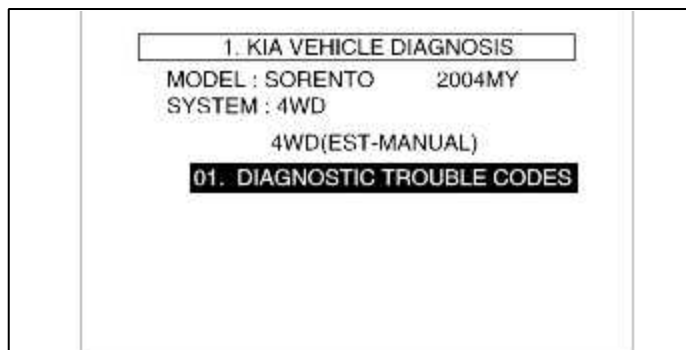


(4) Select "4WD(EST-MANUAL)".



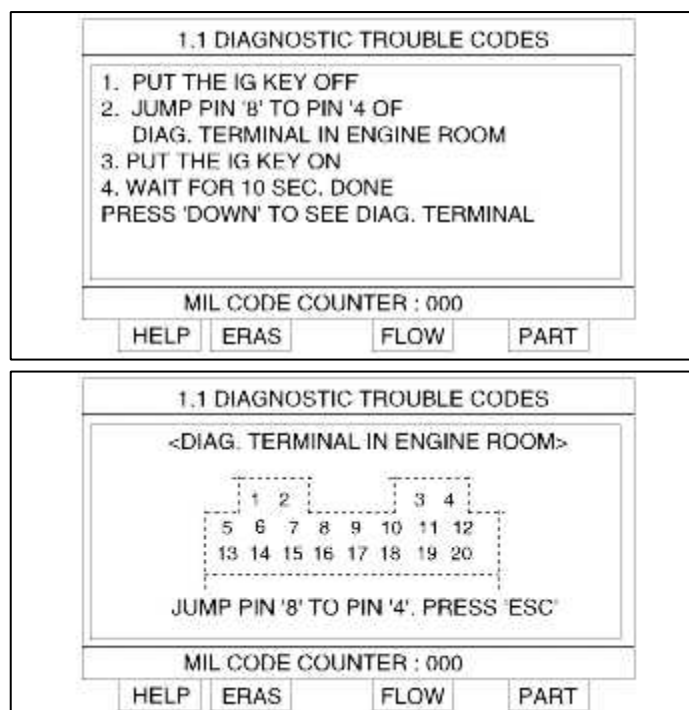
(5) Select "01.DIAGNOSTIC TROUBLE CODES".

It shows diagnostic trouble code list.



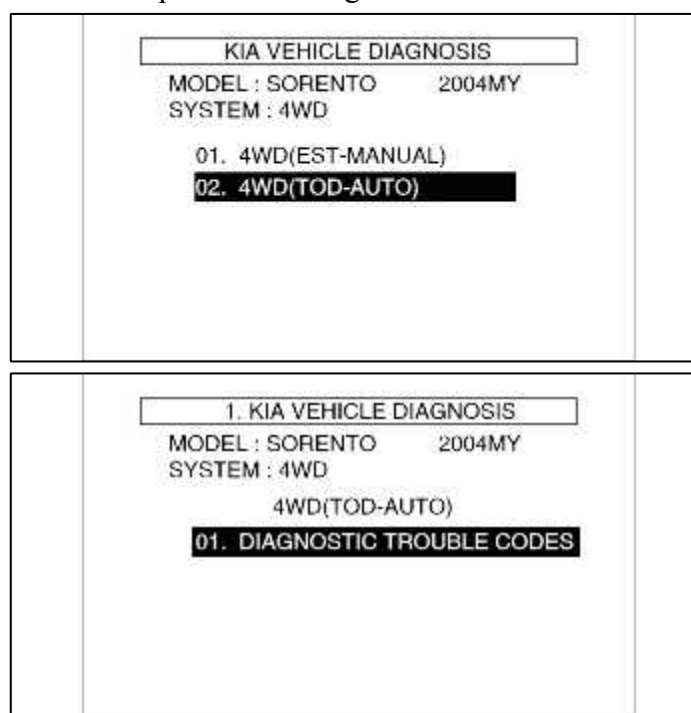
ERAES THE DIAGNOSTIC TROUBLE CODES FOR EST

1. Select and operate according to the instructions on the Hi-scan screen.
  - (1) Select "KIA VEHICLE DIAGNOSIS".
  - (2) Select "VEHICLE NAME".
  - (3) Select "4WD SYSTEM".
  - (4) Select "4WD(EST-MANUAL)".
  - (5) Select "01.DIAGNOSTIC TROUBLE CODES".



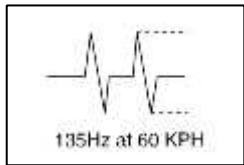
#### SELF-DIAGNOSIS PROCEDURE FOR TOD(AUTO)

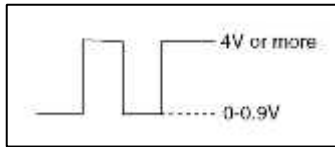
1. Select and operate according to the instructions on the Hi-scan screen. (Refer to EST(MANUAL) procedures)



#### EST standard input and output value in TCCM

No.	Items	Condition	Signal		Remarks
			Type	Level	

1	A1	MOTOR OUTPUT (2H-4H-4L)	IDLE("N")	DC	Vbatt	*Current : INRUSH(+) : 4.64A INRUSH(-) : 4.4A OPERATION : 0.6A
				↑	0V	
2	A2	MOTOR OUTPUT (2H-4H-4L)	IDLE("N")	DC	Vbatt	
				↑	0V	
3	A3	GND				
4	A4	CLUTCH COIL	IDLE (2H→4H→4L)	DC	Vbatt	*Current : 4.28A
				↑	0V	
5	A5	POSITION 1 MTR	IDLE (P/R/N/D/2/L)	2H 2H→4H 4H→4L	CODE : 1010 CODE : 0011 CODE : 1100 LOGIC HI(1) : 5V LOGIC LO(0) : 0.5V or less	*MTR POS. CODE : 1/2/3/4 = XXXX (1=5V dc) (0≤0.5V dc)
6	A6	SPEED SENSOR	IDLE	PULSE		*VSS of 60KPH : HI : 16.4V LOW : -6.4V
7	A7	2H SW.	SW OFF	DC	4.5 ~ 5.5V	
			SW ON	↑	0.5V or less	
8	A8	4H DISPLAY	SW OFF	DC	Vbatt	
			SW ON	↑	0.5V or less	
9	A9	BATT	IGN OFF	DC	Vbatt	
			IGN ON	↑	Vbatt	
10	A10	BATT	IGN OFF	DC	Vbatt	
			IGN ON	↑	Vbatt	
11	A11	GND				
12	A12	POSITION 2 MTR	IDLE (P/R/N/D/2/L)	2H 2H→4H 4H→4L	CODE : 1010 CODE : 0011 CODE : 1100 LOGIC HI(1) : 5V LOGIC LO(0) : 0.5V or less	*MTR POS. CODE : 1/2/3/4 = XXXX (1=5V dc) (0≤0.5V dc)
13	A13	4L SW	SW OFF	DC	4.5 ~ 5.5V	
			SW ON	↑	0.5V or less	
14	A14	INHIBITOR SW(AT) CLUTCH INTERLOCK SW(MT)	N	DC	0V	
			P/R/D/2/L	↑	Vbatt	

15	A15	4L DISPLAY	IDL("N")	DC	Vbatt	
				↑	0V	
16	A16	MOTOR OUTPUT (4L→4H→2H)	IDL("N")	DC	Vbatt	
				↑	0V	
21	A21	POSITION 3 MTR	IDLE (P/R/N/D/2/L)	2H 2H→4H 4H→4L	CODE : 1010 CODE : 0011 CODE : 1100 LOGIC HI(1) : 5V LOGIC LO(0) : 0.5V or less	*MTR POS. CODE : 1/2/3/4 = XXXX (1=5V dc) (0≤0.5V dc)
22	A22	DIA.DISPLAY	In comm.	PULSE		
23	A23	FRRD SOLENOID	IDLE (2H→4H)	OFF		
				ON		

## WARNING LAMP OPERATING CONDITIONS

Items	Condition	INDICATOR		Description
		4LOW	W/Lamp	
TPS	OPEN OR SHORT(GND)	OFF	OFF	1. No warning lamp blink or ON 2. AUTO ↔ 4LOW shift is possible
SHIFT MOTOR	OPEN	OFF	Blink	1. Warning lamp blinks after 1 sec. since the fault is occurred. 2. Fail at the "AUTO mode" - AUTO mode holding - "4LOW" lamp blinks if "4L" is selected 3. Fail at the "4LOW mode" - 4L mode holding - "4LOW lamp" blinks if "AUTO" is selected 4. Even though the fault is repaired, shift prevention is still existed. If IG. ON again, system is operated normally.
SHIFT MOTOR POSITION SENSOR (1), (2), (3), (4)	OPEN Short to battery	OFF	Blink	1. Warning lamp blinks after 1 sec. since the fault is occurred. 2. Fail at the "AUTO mode" - AUTO mode holding - "4LOW" lamp blinks if "4L" is selected 3. Fail at the "4LOW mode" - 4L mode holding - "4LOW" lamp blinks if "AUTO" is selected
	SHORT(GND)			



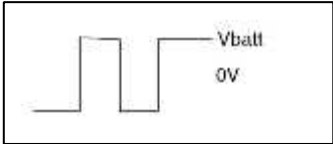
				4. Even though the fault is repaired, shift prevention is still existed. If IG. ON again, system is operated normally.
FRT SPEED SENSOR	OPEN	OFF	OFF	1. Warning lamp blinks after 0.5 sec. since the fault is occurred. 2. Fail at the "AUTO mode" - AUTO mode holding - "4LOW" lamp blinks if "4L" is selected
RR SPEED SENSOR	OPEN	OFF	OFF	3. Fail at the "4LOW mode" - 4L mode holding - "4LOW" lamp blinks if "AUTO" is selected 4. Even though the fault is repaired, shift prevention is still existed. If IG. ON again, system is operated normally.
EMC (ELECTRO MAGNETIC CLUTCH)	OPEN	OFF	Blink	1. Warning lamp blinks after 0.8 sec. since the fault is occurred. 2. Fail at the "AUTO mode" - "AUTO" mode holding - "4LOW" lamp blinks if "4L" is selected
	SHORT(GND)	OFF	Blink	3. Fail at the "4LOW mode" - 4L mode holding - "4LOW" lamp blinks if "AUTO" is selected 4. Even though the fault is repaired, shift prevention is still existed. If IG. ON again, system is operated normally.

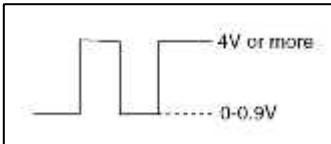
## DTC LIST AND FAILSAFE

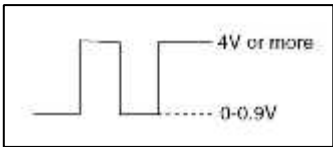
No.	Description	P-code	Failure effect	Fail-safe	W/Lamp
1	EEPROM check sum fault	P1725	TOD	Default calibration data	-
2	TPS loss of signal	P1726	TOD (TPS Idle)	TOD Determined by wheel slip only	OFF
3	TPS out of range	P1727	TOD (TPS Idle)	TOD Determined by wheel slip only	OFF
4	EMC open/shorted to battery	P1728	TOD Halted (2WD)	None	Blink
5	EMC shorted to ground	P1729	TOD Halted (2WD)	None	Blink
6	Front speed sensor voltage low	P1730	TOD	4H mode fail, Rear speed sensor, EMC Touch off level fixing. 4L Mode fail, EMC Maximum level fixing.	OFF
7	Front speed sensor voltage high	P1731	TOD		OFF

8	Rear speed sensor voltage low	P1732	TOD	4H mode fail, Front speed sensor, EMC Touch off level	OFF
9	Rear speed sensor voltage high	P1733	TOD	fixing. 4L Mode fail, EMC Maximum level fixing.	OFF
10	Vehicle speed sensor reference voltage low	P1734	TOD	4H mode fail, Zero speed sensor, EMC Touch off level	OFF
11	Vehicle speed sensor reference voltage high	P1735	TOD	fixing. 4L Mode fail, EMC Maximum level fixing.	OFF
12	Shift motor open/shorted to battery	P1736	Electric motor shifting (4H→4L→4H)	No shifts	Blink
13	Shift motor open/shorted to ground	P1737	Electric motor shifting (4H→4L→4H)	No shifts	Blink
14	Shift system timeout	P1738	Electric motor shifting (4H→4L→4H)	No shifts	Blink
15	General position encoder fault	P1739	Electric motor shifting (4H→4L→4H)	No shifts	OFF
16	Position 1 shorted to ground	P1740	Electric motor shifting (4H→4L→4H)	No shifts	OFF
17	Position 2 shorted to ground		Electric motor shifting (4H→4L→4H)	No shifts	
18	Position 3 shorted to ground		Electric motor shifting (4H→4L→4H)	No shifts	
19	Position 4 shorted to ground		Electric motor shifting (4H→4L→4H)	No shifts	

## STANDARD INPUT AND OUTPUT VALUE IN TODCM

No.	Items	Condition	Signal		Remarks
			Type	Level	
1	A1	MOTOR OUTPUT (HI-LOW)	DC	Vbatt	
				↑ 0V	
2	A2	MOTOR OUTPUT (LOW-HI)	DC	Vbatt	
				↑ 0V	
3	A3	EMC	Vehicle driving	PULSE (PWM)	 <p>FREQ : 50Hz DUTY(-) : 0~88%</p>
4	A4	BATT	IGN OFF	DC	Vbatt
			IGN ON	↑	Vbatt

5	A5	IGN 1	IGN OFF	DC	0V	
			IGN ON	↑	Vbatt	
6	B1	ENCODER GND				
7	B2	DIAGNOSTIC DISPLAY	LAMP OFF	DC	Vbatt	
			LAMP ON	↑	0.5V or less	
8	B3	TPS (PWM)	ACCEL C.T & W.O.T	PWM	HI : 4V MIN LOW : 0.9V MAX FREQ : 100Hz DUTY(-) : C.T-10%, W.O.T-83%	
9	B4	AUTO/LOW SW.	IDLE (A/T LEVER "N")	AUTO LOW	4V or more 0.9V or less (AUTO mode : 4V or more)	
10	B5	SHIFT MOTOR POSITION 2	IDLE (A/T LEVER "N")	→AUTO →LOW	CODE : 0010 → 0000 CODE : 0101 → 0000 LOGIC HI(1) : 4.5V or more LOGIC LO(0) : 0.5V or less	*MTR POS. CODE : 1/2/3/4 = XXXX
11	B6	FRT SPEED SNSR	Vehicle driving	PULSE	 <p>30PULSE/PROPSHAFT REV. DUTY(-) : 50%</p>	*VSS 60KPH : 985Hz
12	B7	N.A				
13	B8	SPEED SNSR GND				
14	A6	MOTOR OUTPUT (HI-LOW)	IDLE("N")	DC	Vbatt	
				↑	0V	
15	A7	MOTOR OUTPUT (LOW-HI)	IDLE("N")	DC	Vbatt	
				↑	0V	
16	A8	SPEED REFERENCE	IGN OFF	DC	0.9V or less	
			IGN ON	↑	4.75~5.25V	
17	A9	GND FOR ECU				
18	A10	GND FOR ECU				
19	A11	BATT	IGN OFF	DC	Vbatt	
			IGN ON	↑	Vbatt	
20	A12	K-LINE	In comm. (10.4Kbps)	PULSE	LOGIC "0" : Vbatt 20% or less LOGIC "1" : Vbatt 80% or more	

21	B9	4LOW DISPLAY	SW OFF	DC	Vbatt	*IGN ON : Turned on for 3sec.
			SW ON	↑	0.5V or less	
22	B10	N.A				
23	B11	N.A				
24	B12	TRANS. NEUTRAL	N	DC	0.9V or less	
			P/R/D/2/L	↑	4.5 ~5.5V	
25	B13	ABS INPUT	ABS OFF	DC	4.5 ~5.5V	
			ABS ON	↑	0.9V or less	
26	B14	BRAKE SW.	SW OFF	DC	0.9V or less	
			SW ON	↑	Vbatt	
27	B15	SHIFT MOTOR POSITION 1	IDLE (A/T LEVER "N")	→AUTO →LOW	CODE : 0010 → 0000 CODE : 0101 → 0000 LOGIC HI(1) : 4.5V or more LOGIC LO(0) : 0.5V or less	*MTR POS. CODE : 1/2/3/4 = XXXX
28	B16	SHIFT MOTOR POSITION 3	IDLE (A/T LEVER "N")	→AUTO →LOW	CODE : 0010 → 0000 CODE : 0101 → 0000 LOGIC HI(1) : 4.5V or more LOGIC LO(0) : 0.5V or less	*MTR POS. CODE : 1/2/3/4 = XXXX
29	B17	RR SPEED SNSR	Vehicle driving	PULSE	 <p>30PULSE/PROPSHAFT REV. DUTY(-) : 50%</p>	*VSS 60KPH : 966Hz
30	B18	SHIFT MOTOR POSITION 4	IDLE (A/T LEVER "N")	→AUTO →LOW	CODE : 0010 → 0000 CODE : 0101 → 0000 LOGIC HI(1) : 4.5V or more LOGIC LO(0) : 0.5V or less	*MTR POS. CODE : 1/2/3/4 = XXXX

## INSPECTION PROCEDURES FOR DIAGNOSTIC TROUBLE CODES

### DESCRIPTIONS

TOD control unit starts self-diagnostic function after the ignition is switched ON.

If TOD control unit detects failure for each circuit and component by comparing condition of the system with limited condition set inside TOD control unit, TOD control unit stores the failure code.

The failure code stored in TOD control unit can be confirmed by scan tool and then outputs the four-digit code to the scan tool when the scan tool is connected to TOD data link connector in the engine room.

Please refer to the self-diagnosis procedure for TOD(auto) in detail as followed.

### DIAGNOSTIC TROUBLE CODE SUMMARY

CODE	POSSIBLE CAUSE	REMEDY
P1725	EEPROM CHECKSUM error - When EEPROM CHECKSUM of TCCU is error	1. Measure TCCU supply voltage 2. Inspect ground 3. Inspect connection of relevant connector

		4. Inspect malfunction of TCCU
P1726	No signal of throttle position - When the signal of throttle position is not recognized	1. Inspect communication line connection between engine ECU and TCCU 2. Diagnose defect of engine ECU 3. Inspect malfunction of TCCU
P1727	Abnormality of throttle position signal - When the throttle position signal is error	1. Inspect communication line connection between engine ECU and TCCU 2. Diagnose defect of engine ECU
P1728	Open/short circuit of electro magnetic clutch(EMC) - When the electro magnetic clutch(EMC), the relevant connector or the wire is error	1. Measure supply voltage of EMC <ul style="list-style-type: none"> <li>• Inspection condition: IG ON / Engine driving</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU No.4 and No.17 : 11-15V</li> </ul> </li> </ul> 2. Measure resistance of EMC(Item condition) <ul style="list-style-type: none"> <li>• Inspection condition: With disconnecting the connector, inspect the wire side connector pin</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal resistance between TCCU pin No.3 and No.17 : 2.5 <math>\Omega</math></li> <li>- Terminal voltage between TCCU pin No. 3 and No.17: LOW : 0V, HIGH : 11-15V</li> </ul> </li> </ul> 3. Inspect open/short circuit of cable related to the electro magnetic clutch(EMC) 4. Inspect abnormal connection of connector related to EMC
P1729	Open(GND) circuit of EMC - When the EMC or the relevant connector or the wire is error	1. Inspect supply voltage of EMC <ul style="list-style-type: none"> <li>• Inspection condition: IG ON / Engine driving</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU No.4 and No.17 : 11-15V</li> </ul> </li> </ul> 2. Measure resistance of EMC(Item condition) <ul style="list-style-type: none"> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal resistance between TCCU pin No.3 and No.17 : 2.5 <math>\Omega</math></li> <li>- Terminal voltage between TCCU pin No. 3 and No.17 : LOW : 0V, HIGH : 11-15V</li> </ul> </li> </ul>
P1730	Low voltage of front speed sensor - When front speed sensor is too low output voltage	1. Inspect output waveform of front speed sensor <ul style="list-style-type: none"> <li>• Inspection condition: At driving</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU pin No. 11 and No.13: LOW : below 0.9V, HIGH : 4.75-5.25V</li> </ul> </li> </ul> 2. Inspect abnormal connection of the relevant connector

		3. Inspect open/short circuit related to cable
P1731	High voltage of front speed sensor - When front speed sensor is too high output voltage	<ol style="list-style-type: none"> <li>1. Inspect output waveform of front speed sensor <ul style="list-style-type: none"> <li>• Inspection condition: At driving</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU pin No. 11 and No.13: LOW : below 0.9V, HIGH : 4.75-5.25V</li> </ul> </li> </ul> </li> <li>2. Inspect abnormal connection of the relevant connector</li> <li>3. Inspect open/short circuit related to cable</li> </ol>
P1732	Low voltage of rear speed sensor - When rear speed sensor is too low output voltage	<ol style="list-style-type: none"> <li>1. Inspect output waveform of rear speed sensor <ul style="list-style-type: none"> <li>• Inspection condition: At driving</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU pin No. 29 and 13 : LOW : below 0.9V, HIGH : 4.75-5.25V</li> </ul> </li> </ul> </li> <li>2. Inspect abnormal connection of the relevant connector</li> <li>3. Inspect open/short circuit related to cable</li> </ol>
P1733	High voltage of rear speed sensor - When rear speed sensor is too high output voltage	<ol style="list-style-type: none"> <li>1. Inspect output waveform of rear speed sensor <ul style="list-style-type: none"> <li>• Inspection condition: At driving</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU pin No. 29 and 13 : LOW : below 0.9V, HIGH : 4.75-5.25V</li> </ul> </li> </ul> </li> <li>2. Inspect abnormal connection of the relevant connector</li> <li>3. Inspect open/short circuit related to cable</li> </ol>
P1734	Low standard voltage of speed sensor - When speed sensor is too low supply voltage	<ol style="list-style-type: none"> <li>1. Measure supply voltage of speed sensor <ul style="list-style-type: none"> <li>• Inspection condition: IG ON / At driving</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU pin No. 16 and 13 : 4.75-5.25V</li> </ul> </li> </ul> </li> <li>2. Inspect abnormal connection of the relevant connector</li> <li>3. Inspect open/short circuit related to cable</li> </ol>
P1735	High standard voltage of speed sensor - When speed sensor is too high supply voltage	<ol style="list-style-type: none"> <li>1. Measure supply voltage of speed sensor <ul style="list-style-type: none"> <li>• Inspection condition: IG ON / At driving</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU pin No. 16 and 13 : 4.75-5.25V</li> </ul> </li> </ul> </li> <li>2. Inspect abnormal connection of the relevant connector</li> <li>3. Inspect open/short circuit related to cable</li> </ol>
	Open/short(power) circuit of shift motor - When the shift motor or the wire of	<ol style="list-style-type: none"> <li>1. Inspect resistance of shift motor</li> </ol>

P1736	motor is error	<ul style="list-style-type: none"> <li>• Inspection condition: With disconnecting the connector, inspect the wire side connector pin</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU No.1 and No.2, No. 1 and No.15 : Specified value : 0.7 <math>\Omega</math></li> <li>- Terminal resistance between TCCU pin No.14 and No.15, No.14 and No.2 : 0.7 <math>\Omega</math></li> </ul> </li> </ul> <ol style="list-style-type: none"> <li>2. Inspect supply voltage of shift motor <ul style="list-style-type: none"> <li>• Inspection condition: IG ON</li> <li>• Specified value : When "4H/4L" switch is operated, 11-15V (Battery voltage)</li> </ul> </li> <li>3. Inspect abnormal connection of the relevant connector</li> <li>4. Inspect open/short circuit related to cable</li> </ol>
P1737	Shift motor output short (GND) - When the shift motor or the wire of motor is error	<ol style="list-style-type: none"> <li>1. Inspect resistance of shift motor <ul style="list-style-type: none"> <li>• Inspection condition: With disconnecting the connector, inspect the wire side connector pin</li> <li>• Specified value <ul style="list-style-type: none"> <li>- Terminal voltage between TCCU No.1 and No.2, No. 1 and No.15 : Specified value : 0.7 <math>\Omega</math></li> <li>- Terminal resistance between TCCU pin No.14 and No.15, No.14 and No.2 : 0.7 <math>\Omega</math></li> </ul> </li> </ul> </li> <li>2. Inspect supply voltage of shift motor <ul style="list-style-type: none"> <li>• Inspection condition: IG ON</li> <li>• Specified value : When "4H/4L" switch is operated, 11-15V (Battery voltage)</li> </ul> </li> <li>3. Inspect abnormal connection of the relevant connector</li> <li>4. Inspect open/short circuit related to cable</li> </ol>
P1738	Shift system time out - When shift system is error	<ol style="list-style-type: none"> <li>1. Remove the motor and then connect the connector which of condition operate motor. If motor is operated, inspect transfer case assembly but if not, replace motor.</li> <li>2. Inspect open/short circuit related to cable</li> <li>3. Inspect defective connection of the relevant connector</li> </ol>
P1739	Malfunction of position encoder - When the position encoder that recognizes shift motor is error	<ol style="list-style-type: none"> <li>1. Inspect open/short circuit related to cable</li> <li>2. Inspect abnormal connection of the relevant connector</li> <li>3. Inspect encoder</li> </ol>
P1740	Short circuit of "1" position (GND) - At short circuit between encoder signal No.1 and GND	<ol style="list-style-type: none"> <li>1. Inspect open/short circuit related to cable</li> <li>2. Inspect abnormal connection of the relevant connector</li> <li>3. Inspect encoder</li> </ol>

P1741	Short circuit of "2" position (GND) - At short circuit between encoder signal No.2 and GND	1. Inspect open/short circuit related to cable 2. Inspect abnormal connection of the relevant connector 3. Inspect encoder
P1742	Short circuit of "3" position (GND) - At short circuit between encoder signal No.3 and GND	1. Inspect open/short circuit related to cable 2. Inspect abnormal connection of the relevant connector 3. Inspect encoder
P1743	Short circuit of "4" position (GND) - At short circuit between encoder signal No.4 and GND	1. Inspect open/short circuit related to cable 2. Inspect abnormal connection of the relevant connector 3. Inspect encoder

### Transfer System > Transfer Case Assembly > Repair procedures (M5UR1)

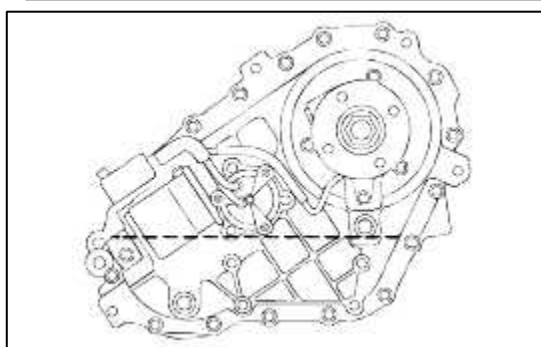
#### SERVICE ADJUSTMENT PROCEDURES

##### FLUID LEVEL INSPECTION

1. Wipe fluid level plug and surrounding area clean.
2. Remove fluid level plug.
3. When transfer case is full, lubricant will just drip out fluid level plug opening.
4. Add approved lubricant if required.
5. Install fluid level plug and torque to 20 - 30 N·m (14 - 22 lb·ft).

#### NOTE

- To check or drain the lubricant, the transfer case should be warm.  
This is best done shortly after shutdown.
- Do not use an impact wrench to remove or install the fill or drain plugs since this will damage female threads in transfer case cover.

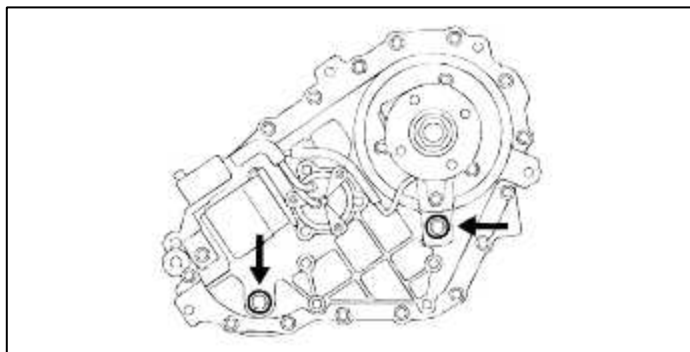


##### FLUID REPLACEMENT

1. Wipe fluid level and drain plug and surrounding areas clean.
2. Place suitable container under transfer case.
3. Remove drain plug.
4. Remove fluid level plug.
5. Allow all lubricant to drain.
6. Install drain plug and torque to 20 - 30 N·m (14 - 22 lb·ft).
7. Add approved lubricant through fluid level plug opening until lubricant just begins to drip back out of opening.



8. Install fluid level plug and torque to 20 - 30 N·m (14 - 22 lb·ft).



### Transfer System > Transfer Case Assembly > Transfer Case > Description and Operation (M5UR1)

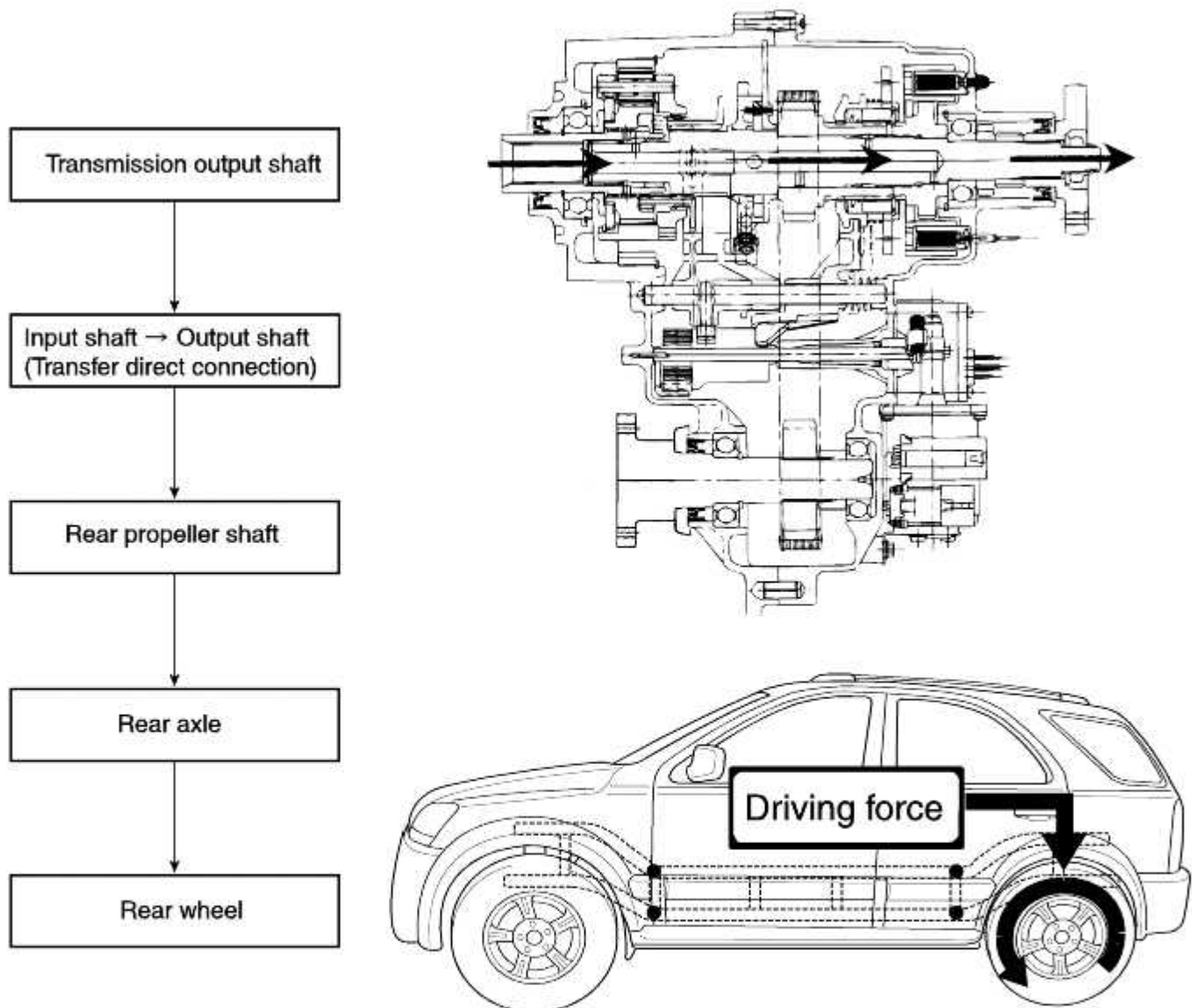
#### 4WD SYSTEM DESCRIPTION

Drive type	Drive item	Drive mode	Drive status	Useful condition
Electric Shift Transfer (EST type)	Drive mode	2H	2WD, Rear wheel drive	Use on the roadway
		4H	4WD HIGH	<ul style="list-style-type: none"> <li>• Use on the off-road or snowy and rainy road having slippery road surface.</li> <li>• When turning on the roadway at low speed, vibration and noise happens by tight corner braking.</li> </ul>
		4L	4WD LOW	Use in the condition which driving force is required like escaping from rough way and towing.
	Transfer	2H ↔ 4H	2WD ↔ 4WD	Possible to transfer 2WD into 4WD and vice versa at 80kph or below during driving.
		4H ↔ 4WD(L)	4WD(H) ↔ 4WD(L)	<ul style="list-style-type: none"> <li>• Necessary to stop the vehicle for transfer               <ul style="list-style-type: none"> <li>- M/T vehicle : Transfer the switch after pressing the clutch pedal.</li> <li>- A/T vehicle : Transfer the switch after positioning the A/T lever to "N".</li> </ul> </li> <li>• All vehicles with 4L mode should stop the vehicle for transfer.</li> </ul>
Active Torque Transfer (ATT type)	Drive mode	AUTO	2WD ↔ 4WD	<ul style="list-style-type: none"> <li>• Use on the various road surfaces including roadway, off-road, or snowy and rainy road having slippery road surface.</li> <li>• Using multiple clutch, control the revolution difference between front and rear wheels electronically. So this mode can correspond to the various road surfaces by controlling the ATT unit automatically.</li> </ul>

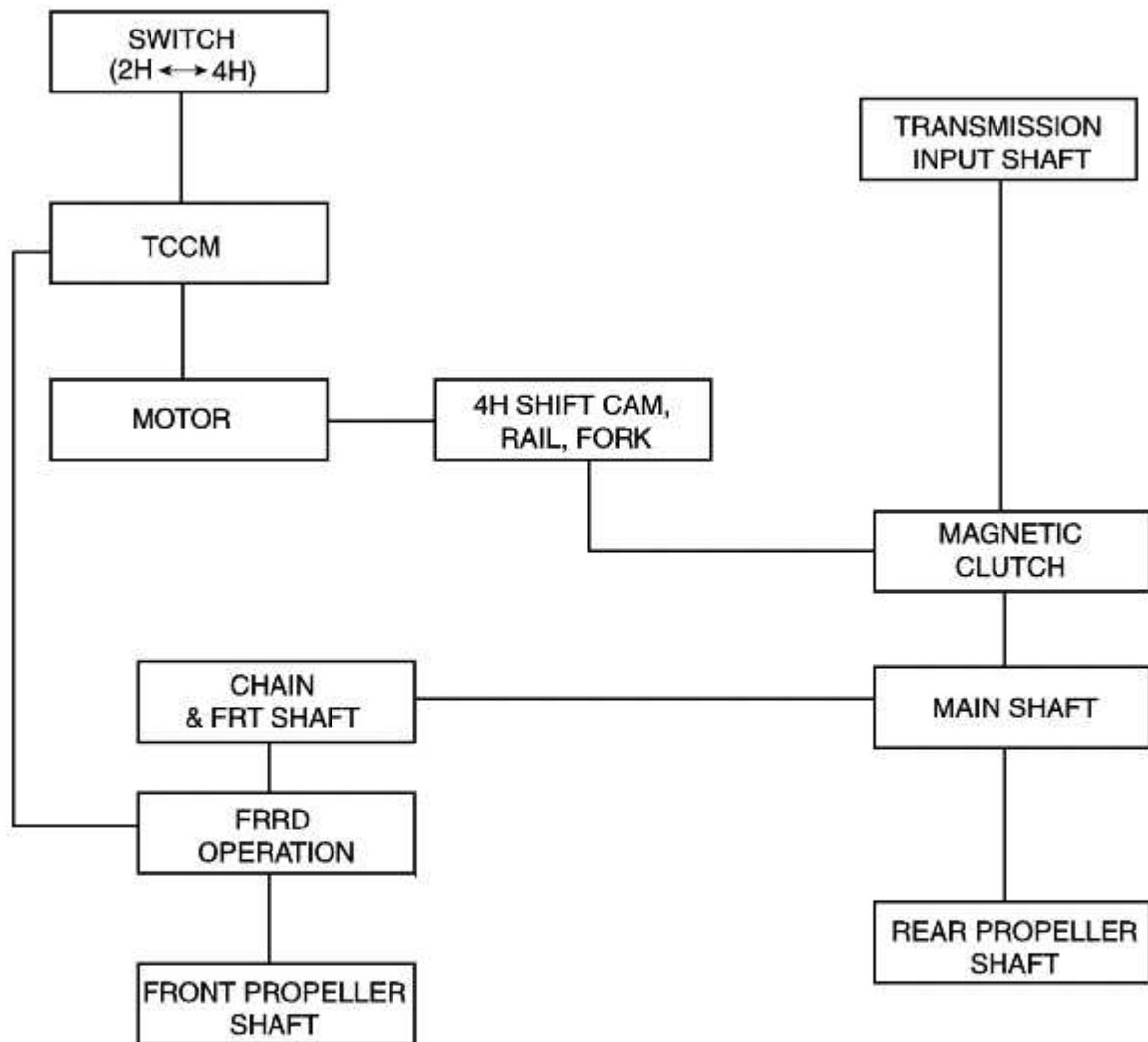
		LOW	4WD LOW	Refer to 4L of part time.
	Transfer	AUTO ↔ LOW	4WD(H) ↔ 4WD(L)	<ul style="list-style-type: none"> <li>• Necessary to stop the vehicle for transfer               <ul style="list-style-type: none"> <li>- M/T vehicle : Transfer the switch after pressing the clutch pedal.</li> <li>- A/T vehicle : Transfer the switch after positioning the A/T lever to "N"</li> </ul> </li> <li>• All vehicles with 4L mode should stop the vehicle for transfer.</li> </ul>

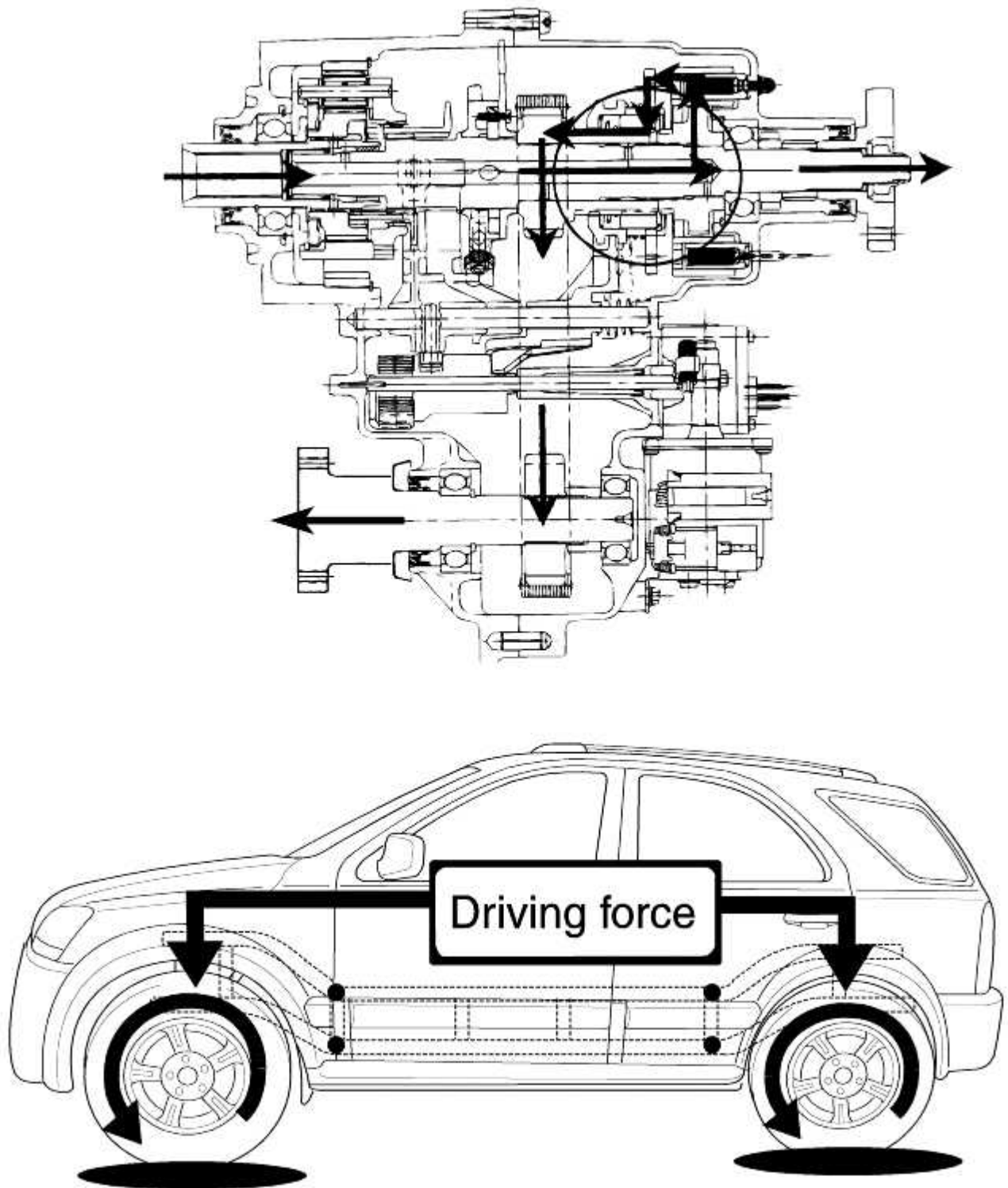
## EST POWER FLOW

## 1. 2H Mode (Rear Wheel Drive)

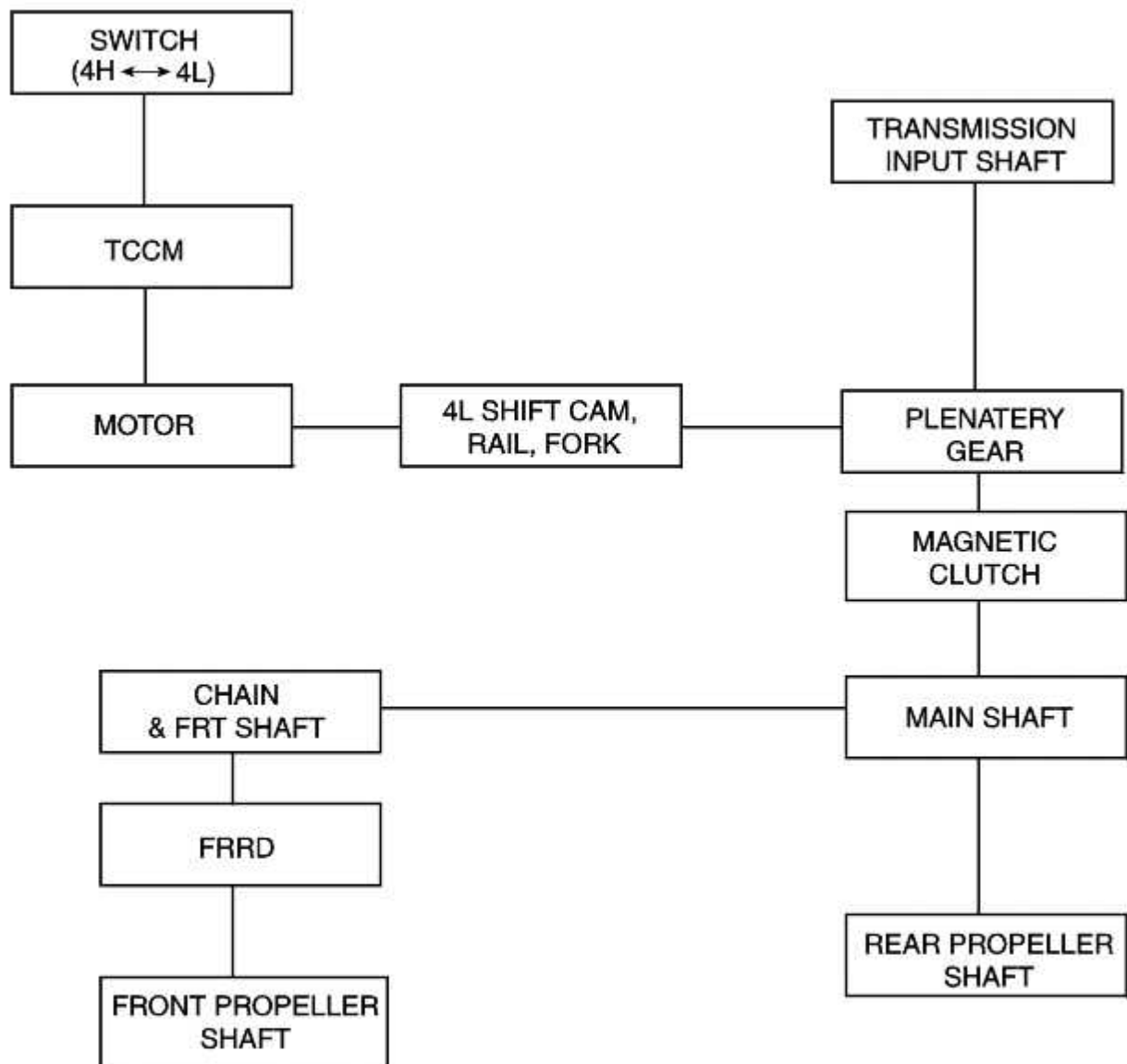


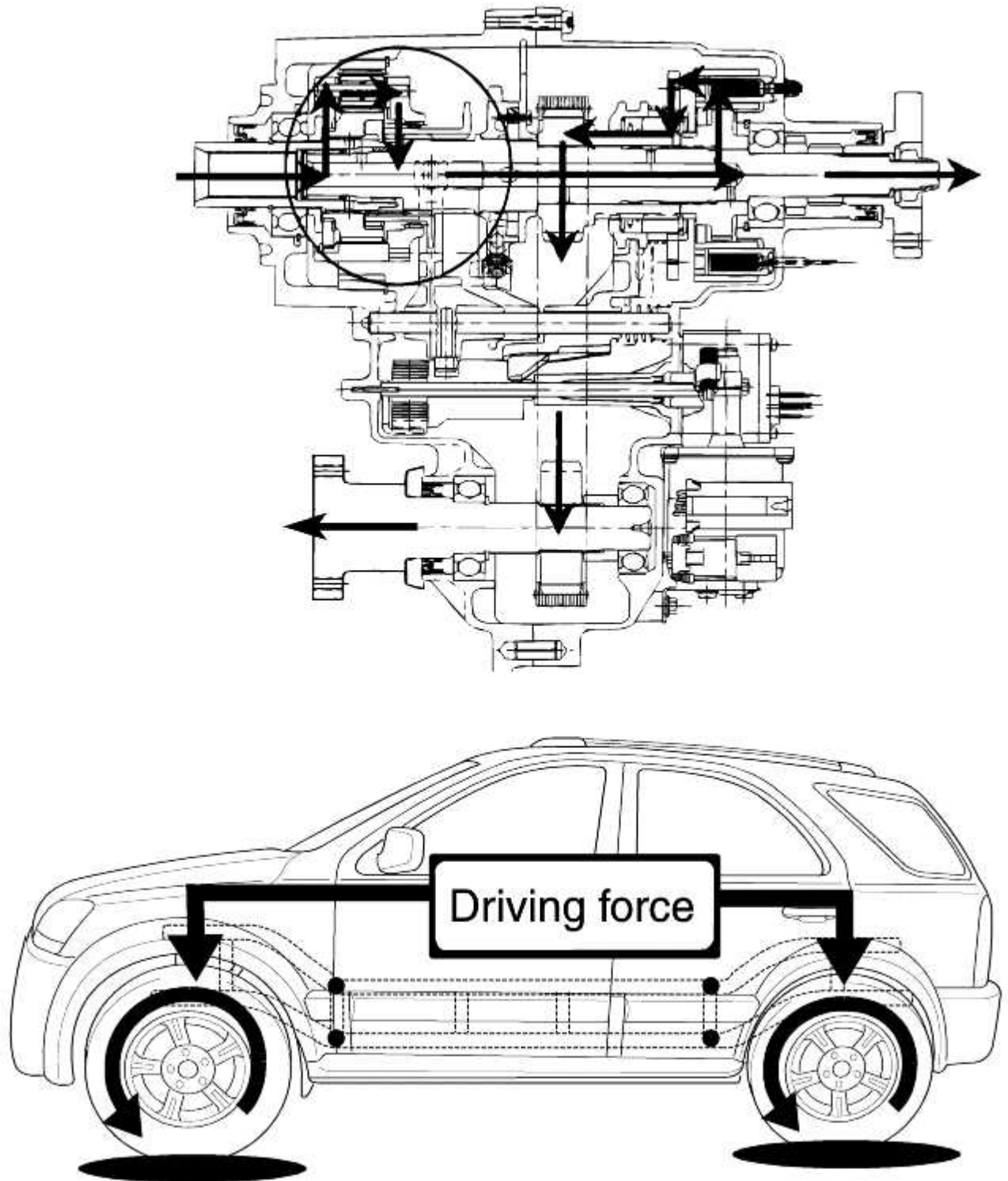
## 2. 4H Mode (Transfer Operation)



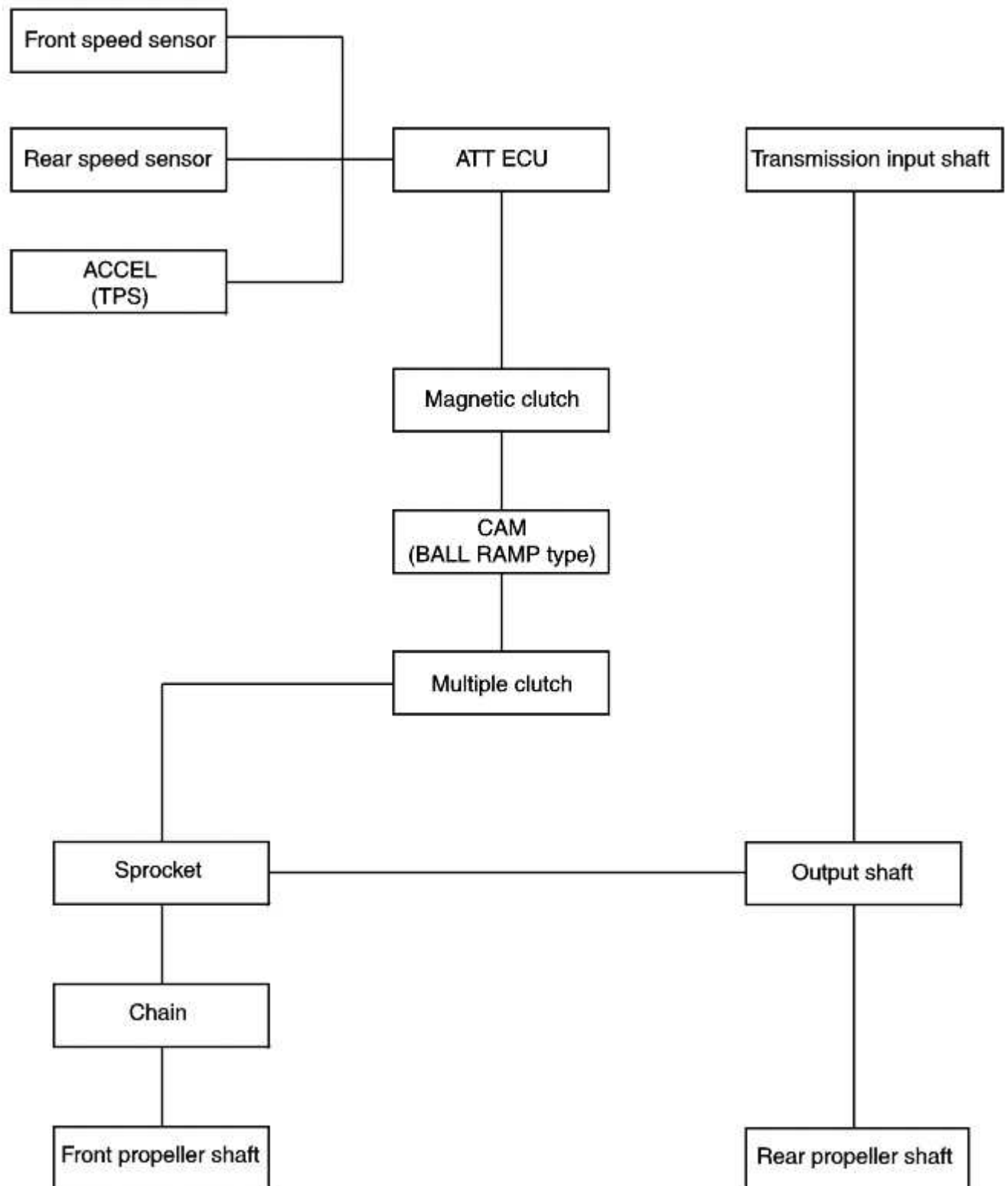


### 3. 4L Mode

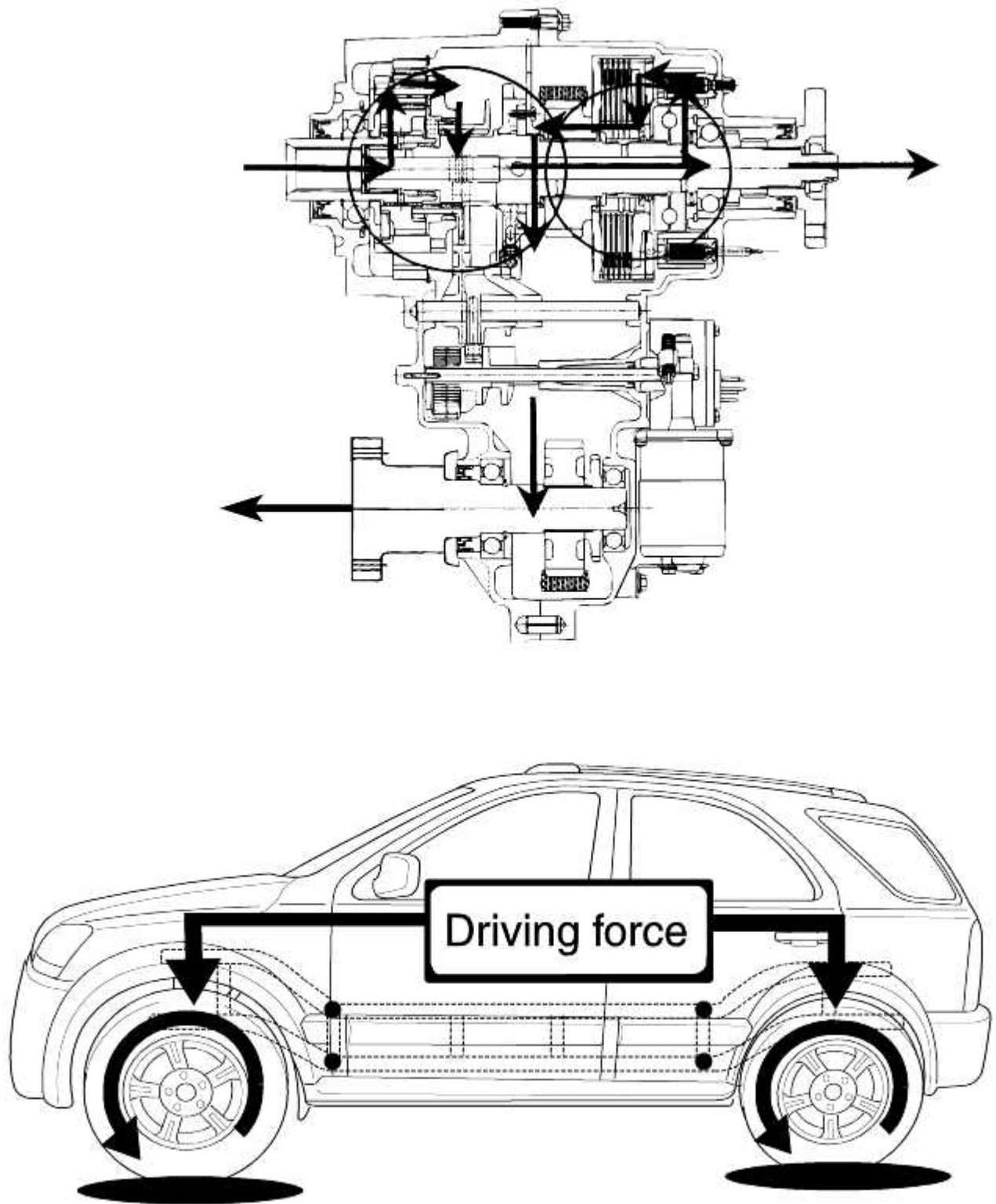




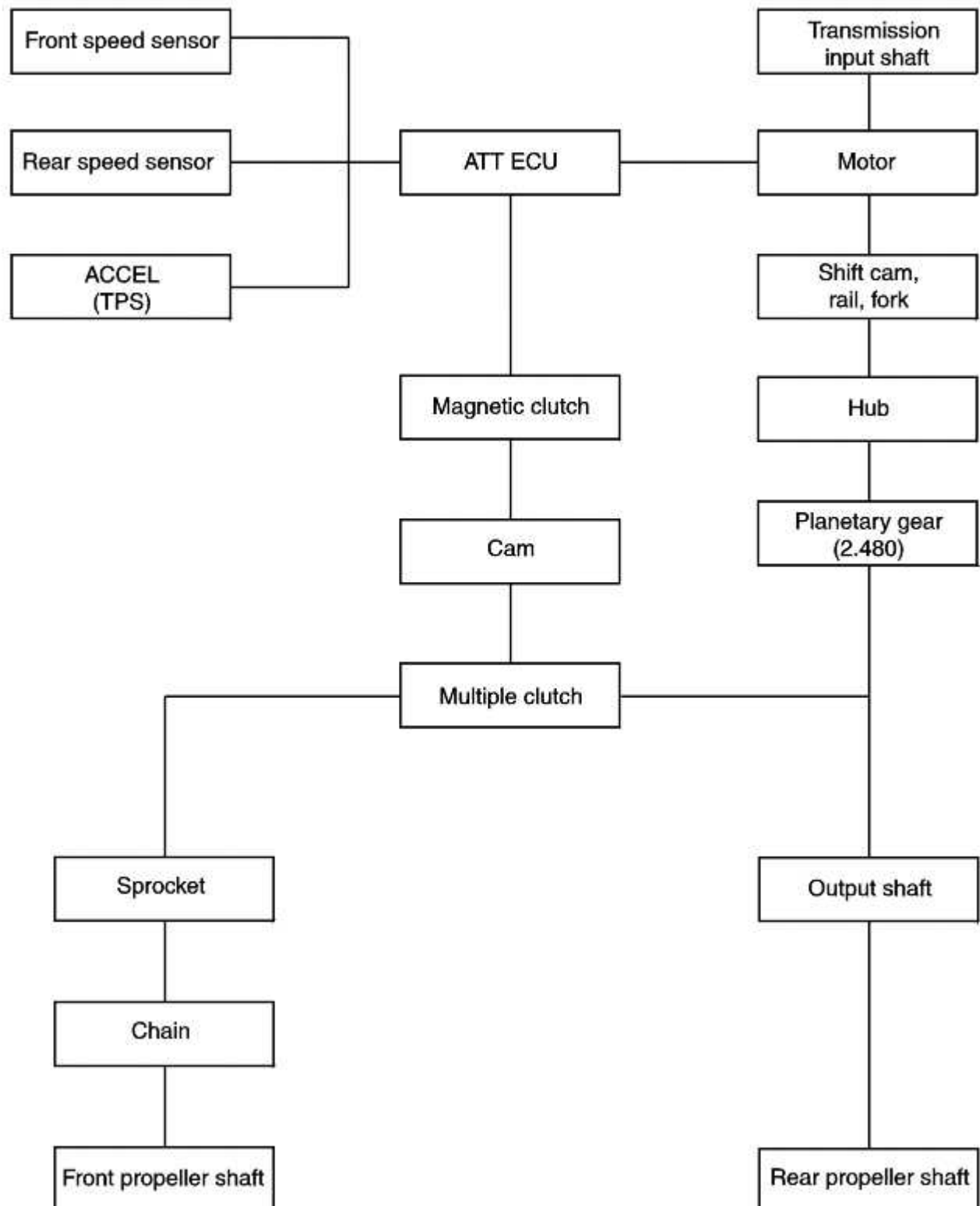
ATT(ACTIVE TORQUE TRANSFER) POWER FLOW  
1. AUTO Mode

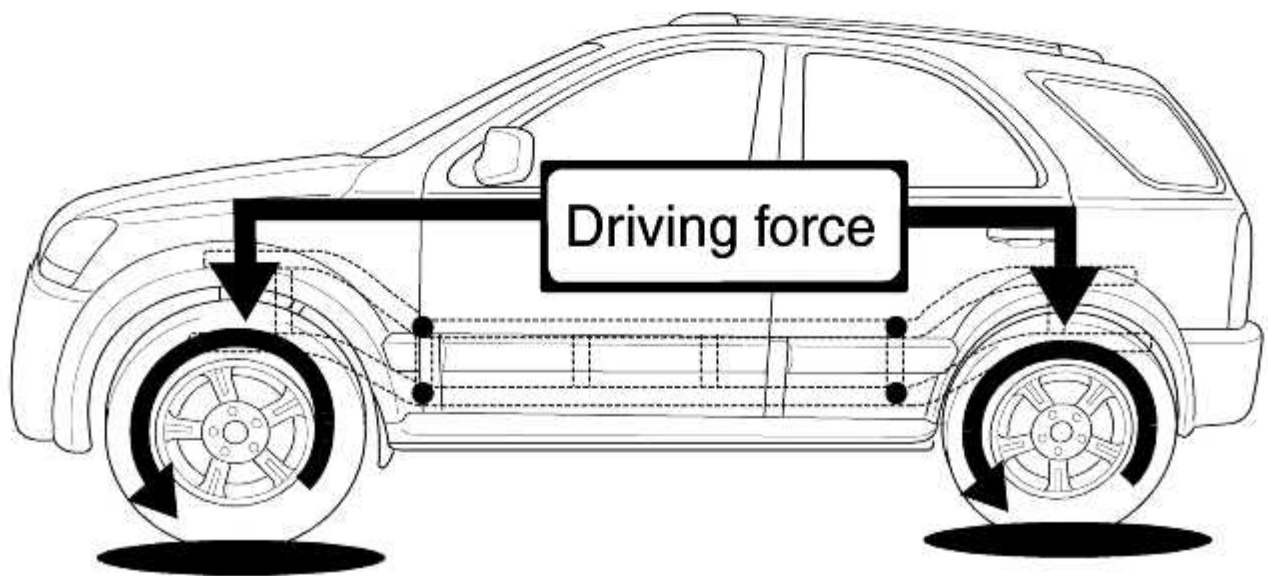
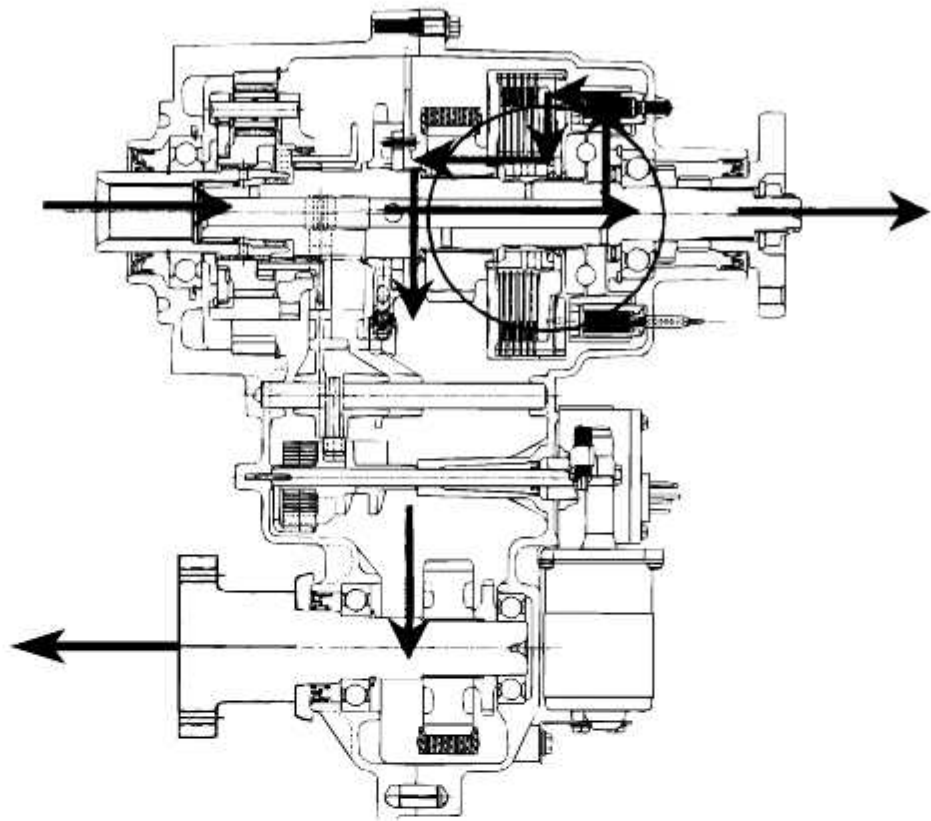






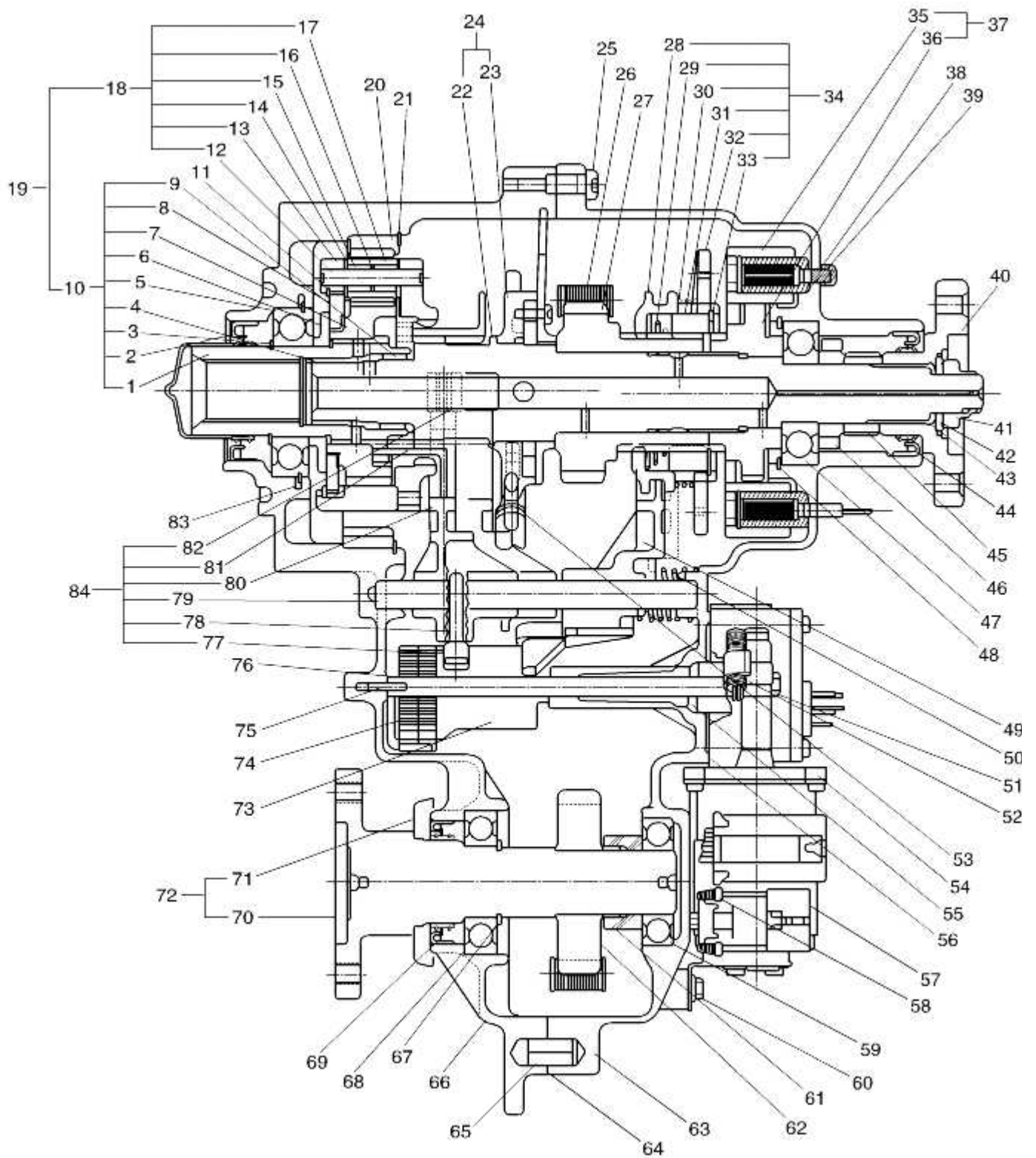
## 2. LOW Mode





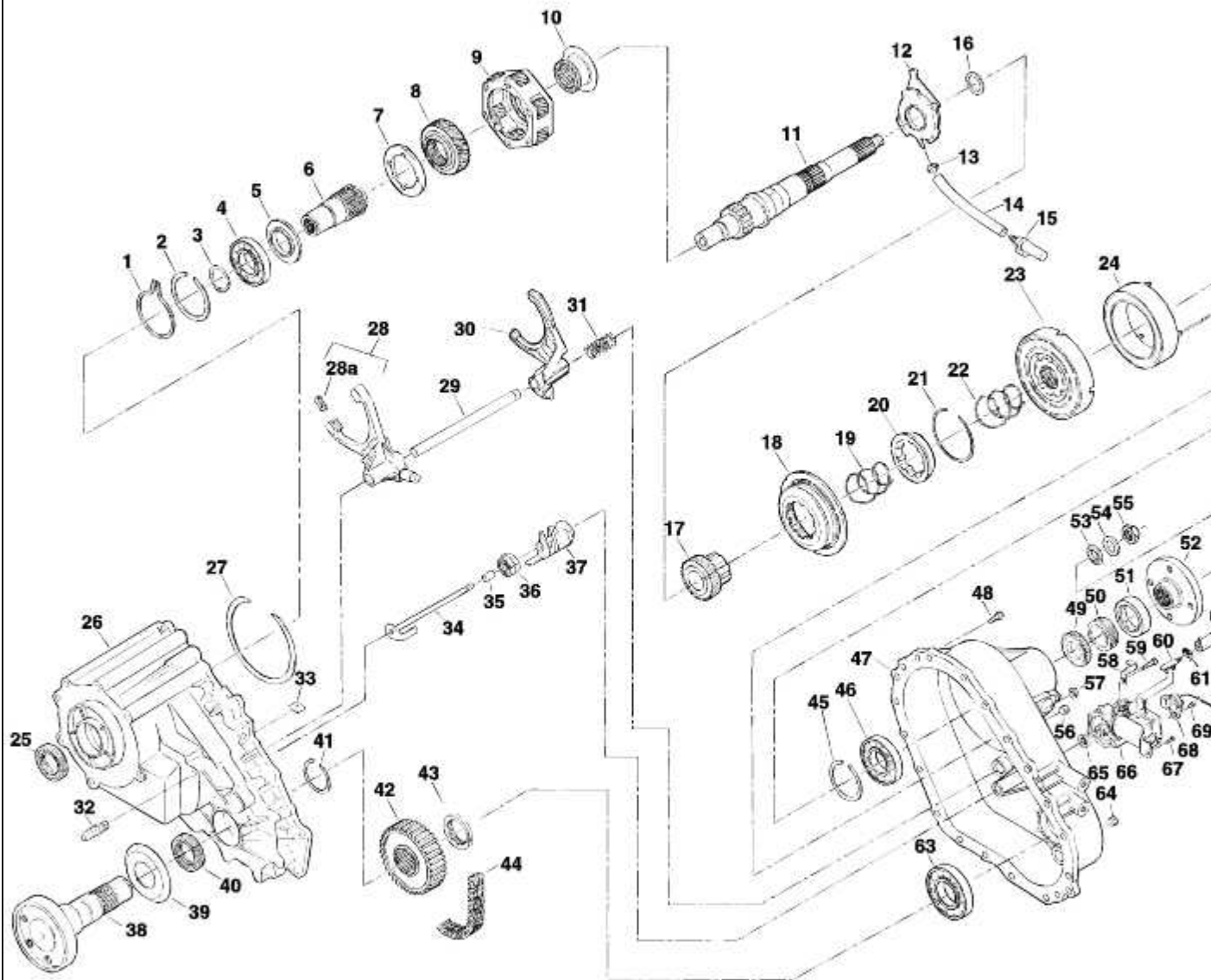
**Transfer System > Transfer Case Assembly > Transfer Case > Components and Components Location (M5UR1)**

EST



- |                               |                                     |
|-------------------------------|-------------------------------------|
| 1. Input shaft                | 43. Oil seal                        |
| 2. Input seal                 | 44. Oil seal                        |
| 3. Snap ring                  | 45. Speedo gear                     |
| 4. Bearing                    | 46. Upper tone wheel                |
| 5. Bearing                    | 47. Bearing                         |
| 6. Circular hub               | 48. Retaining ring                  |
| 7. Sun gear                   | 49. Shift fork                      |
| 8. Trust plate                | 50. Return spring                   |
| 9. Bushing                    | 51. Hex head bolt                   |
| 10. Input shaft sub assembly  | 52. J clip                          |
| 11. Snap ring                 | 53. Hose clamp                      |
| 12. Planet pinion shaft       | 54. Electric motor assembly         |
| 13. Planet carrier            | 55. Oil seal                        |
| 14. Pinion thrust washer      | 56. Sealing compound                |
| 15. Needle roller bearing     | 57. Connector pin                   |
| 16. Pinion needle spacer      | 58. Clip locking                    |
| 17. Pinion gear               | 59. Bearing                         |
| 18. Carrier                   | 60. Hex head cap screw              |
| 19. Carrier assembly          | 61. Spacer                          |
| 20. Ring gear                 | 62. Lower sprocket                  |
| 21. Retaining ring            | 63. Finish cover                    |
| 22. Main shaft                | 64. Sealing compound                |
| 23. Gerotor pump assembly     | 65. Case/cover dowel                |
| 24. Main shaft assembly       | 66. Case sub assembly               |
| 25. Metric bolt               | 67. Snap ring                       |
| 26. Chain                     | 68. Ball bearing                    |
| 27. Lower sprocket            | 69. Oil seal                        |
| 28. Lock up collar            | 70. Output shaft                    |
| 29. Sleeve return spring      | 71. Dust deflector                  |
| 30. Torsion spring            | 72. Front output shaft sub assembly |
| 31. Lockup hub                | 73. Electric shift cam              |
| 32. Armature                  | 74. Torsion spring                  |
| 33. Retaining ring            | 75. Shift shaft                     |
| 34. Lock up collar assembly   | 76. Spacer                          |
| 35. Coil housing              | 77. Cam roller                      |
| 36. Shift hub                 | 78. Pin shift fork                  |
| 37. Cam/coil housing assembly | 79. Shift rail                      |
| 38. Metric nut                | 80. Shift fork                      |
| 39. Electric coil assemble    | 81. Reduction hub                   |
| 40. Companion flange          | 82. Shift fork facing               |
| 41. Metric nut                | 83. Snap ring                       |
| 42. Washer                    | 84. Shift fork assembly             |

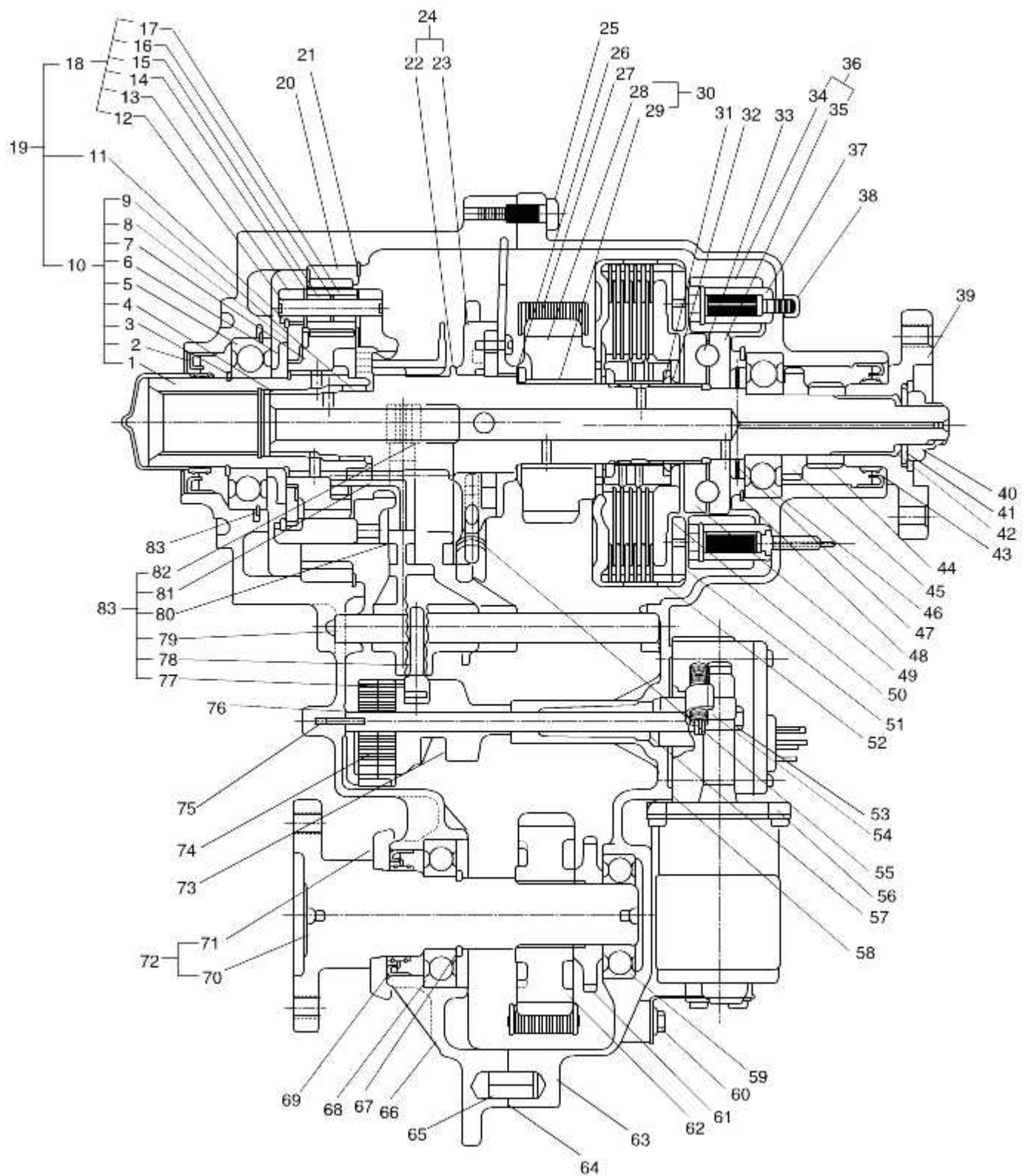
## COMPONENTS (2)



- |                          |                      |
|--------------------------|----------------------|
| 1. Snap ring             | 35. Spacer           |
| 2. Snap ring             | 36. Torsion spring   |
| 3. Snap ring             | 37. Shift cam        |
| 4. Bearing               | 38. Output shaft     |
| 5. Hub                   | 39. Dust deflector   |
| 6. Input shaft           | 40. Oil seal         |
| 7. Thrust plate          | 41. Snap ring        |
| 8. Sun gear              | 42. Lower sprocket   |
| 9. Carrier               | 43. Spacer           |
| 10. Reduction hub        | 44. Chain            |
| 11. Main shaft           | 45. Retaining ring   |
| 12. Rotor pump           | 46. Bearing          |
| 13. Hose clamp           | 47. Cover            |
| 14. Hose                 | 48. Nut              |
| 15. Filter               | 49. Tone wheel       |
| 16. Thrust washer        | 50. Speedo gear      |
| 17. Upper sprocket       | 51. Oil seal         |
| 18. Lock-up collar       | 52. Companion flange |
| 19. Sleeve return spring | 53. Oil seal         |
| 20. Lock-up hub          | 54. Washer           |
| 21. Snap ring            | 55. Nut              |
| 22. Spring               | 56. Pipe plug        |
| 23. Clutch housing       | 57. Nut              |
| 24. Electric coil        | 58. 'J' clip         |
| 25. Oil seal             | 59. Bolt             |
| 26. Transfer case        | 60. Clip             |
| 27. Retaining ring       | 61. Connector lock   |
| 28. Shift fork           | 62. Connector        |
| 28a. Shift fork pad      | 63. Bearing          |
| 29. Shift rail           | 64. Plug             |
| 30. Lock-up fork         | 65. Oil seal         |
| 31. Return spring        | 66. Electric motor   |
| 32. Breather             | 67. Bolt             |
| 33. Magnet               | 68. Speed sensor     |
| 34. Shift shaft          | 69. Bolt             |

ATT (ACTIVE TORQUE TRANSFER)

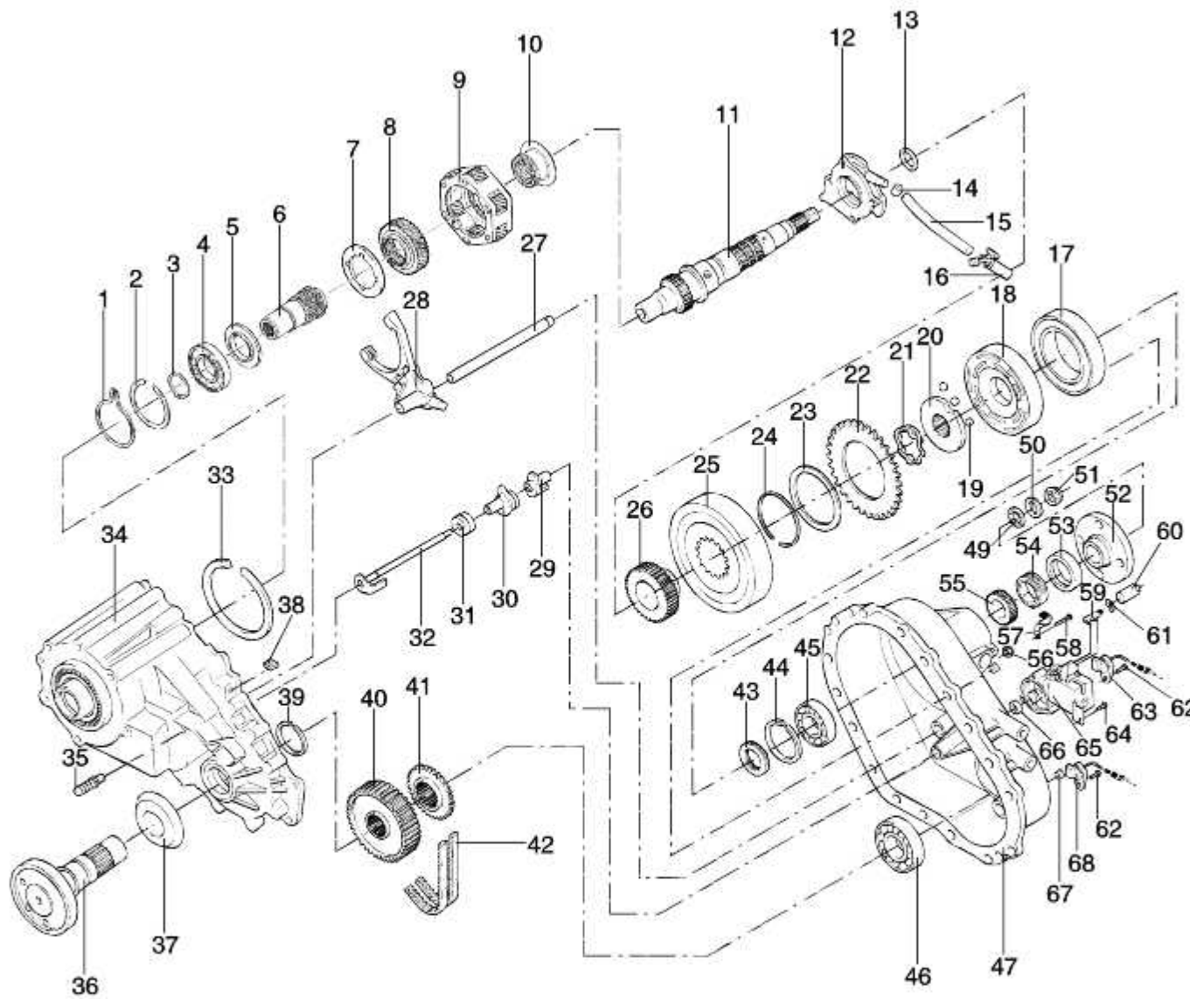
COMPONENTS (1)





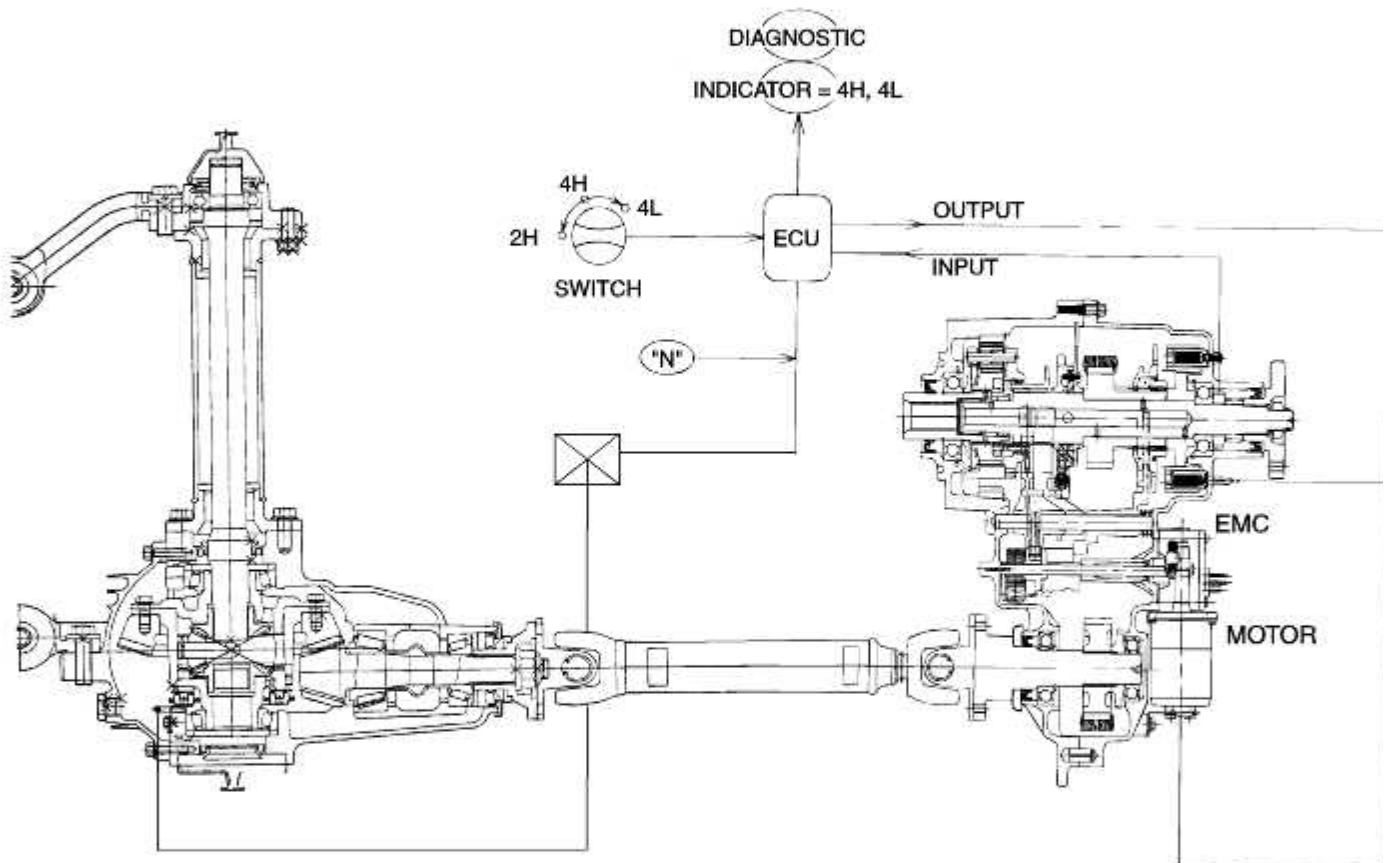
- |                               |                                     |
|-------------------------------|-------------------------------------|
| 1. Input shaft                | 43. Oil seal                        |
| 2. Input seal                 | 44. Speedo gear                     |
| 3. Snap ring                  | 45. Upper tone wheel                |
| 4. Bearing                    | 46. Bearing                         |
| 5. Bearing                    | 47. Thrust bearing assembly         |
| 6. Circular hub               | 48. Retaining ring                  |
| 7. Sun gear                   | 49. Apply cam                       |
| 8. Trust plate                | 50. Insulator washer                |
| 9. Bushing                    | 51. Armature                        |
| 10. Input shaft sub assembly  | 52. Clutch pack assembly            |
| 11. Snap ring                 | 53. Hex head bolt                   |
| 12. Planet pinion shaft       | 54. J clip                          |
| 13. Planet carrier            | 55. Hose clamp                      |
| 14. Pinion thrust washer      | 56. Electric motor assembly         |
| 15. Needle roller bearing     | 57. Oil seal                        |
| 16. Pinion needle spacer      | 58. Sealing compound                |
| 17. Pinion gear               | 59. Bearing                         |
| 18. Carrier                   | 60. Hex head cap screw              |
| 19. Carrier assembly          | 61. Lower tone wheel                |
| 20. Ring gear                 | 62. Lower sprocket                  |
| 21. Retaining ring            | 63. Finish cover                    |
| 22. Main shaft                | 64. Sealing compound                |
| 23. Gerotor pump assembly     | 65. Case/cover dowel                |
| 24. Main shaft assembly       | 66. Case sub assembly               |
| 25. Metric bolt               | 67. Snap ring                       |
| 26. Chain                     | 68. Ball bearing                    |
| 27. Lower sprocket            | 69. Oil seal                        |
| 28. Upper sprocket            | 70. Output shaft                    |
| 29. Bushing                   | 71. Dust deflector                  |
| 30. Drive sprocket assembly   | 72. Front output shaft sub assembly |
| 31. Retaining ring            | 73. Electric shift cam              |
| 32. Wave spring               | 74. Torsion spring                  |
| 33. Ball                      | 75. Shift shaft                     |
| 34. Coil housing              | 76. Spacer                          |
| 35. Base cam                  | 77. Cam roller                      |
| 36. Cam/coil housing assembly | 78. Pin shift fork                  |
| 37. Coil electric assembly    | 79. Shift rail                      |
| 38. Metric nut                | 80. Shift fork                      |
| 39. Companion flange          | 81. Reduction hub                   |
| 40. Metric nut                | 82. Shift fork facing               |
| 41. Washer                    | 83. Snap ring                       |
| 42. Oil seal                  | 84. Shift fork assembly             |

## COMPONENTS (2)



- |                        |                        |
|------------------------|------------------------|
| 1. Snap ring           | 38. Magnet             |
| 2. Snap ring           | 39. Snap ring          |
| 3. Snap ring           | 40. Lower socket       |
| 4. Bearing             | 41. Lower tone wheel   |
| 5. Circula hub         | 42. Chain              |
| 6. Input shaft         | 43. Bearing thrust     |
| 7. Thrust plate        | 44. Retaining ring     |
| 8. Sun gear            | 45. Bearing            |
| 9. Carrier             | 46. Bearing            |
| 10. Reduction hub      | 47. Cover              |
| 11. Main shaft         | 48. Metric bolt        |
| 12. Pump               | 49. Oil seal           |
| 13. Thrust washer      | 50. Washer             |
| 14. Hose clamp         | 51. Metric nut         |
| 15. Hose               | 52. Companion flange   |
| 16. Filter             | 53. Oil seal           |
| 17. Electric coil      | 54. Speedo gear        |
| 18. Cam coil housing   | 55. Upper tone wheel   |
| 19. Ball               | 56. Metric nut         |
| 20. Cam apply          | 57. J-clip             |
| 21. Wave spring        | 58. Hex head bolt      |
| 22. Amateur            | 59. Clip               |
| 23. Insulator washer   | 60. Connector          |
| 24. Retaining ring     | 61. Connector lock     |
| 25. Clutch pack        | 62. Hex head bolt      |
| 26. Drive sprocket     | 63. Upper speed sensor |
| 27. Shift rail         | 64. Hex head cap screw |
| 28. Shift fork         | 65. Electric motor     |
| 29. Electric shift cam | 66. Oil seal           |
| 30. Electric shift cam | 67. Pipe plug          |
| 31. Torsion spring     | 68. Lower speed sensor |
| 32. Shift shaft        |                        |
| 33. Retaining ring     |                        |
| 34. Transfer case      |                        |
| 35. Breather           |                        |
| 36. Output shaft       |                        |
| 37. Dust deflector     |                        |

## ELECTRIC SHIFT TRANSFER

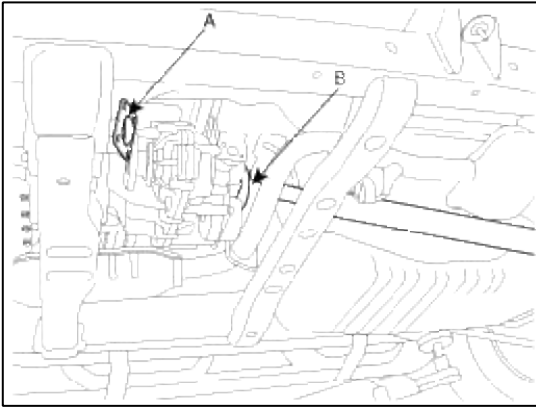


ACTIVE TORQUE TRANSFER

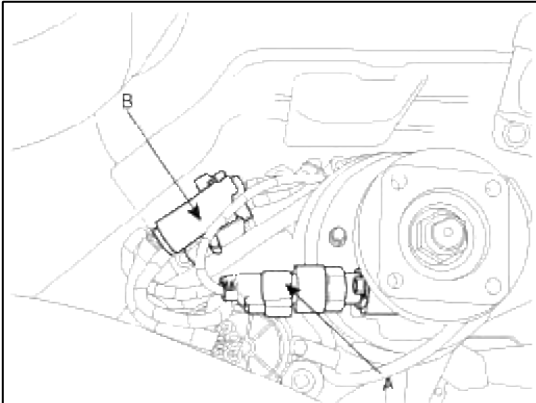
## Removal

1. Disconnect the battery (-) terminal.

2. Remove the front/rear propeller shaft(A,B).



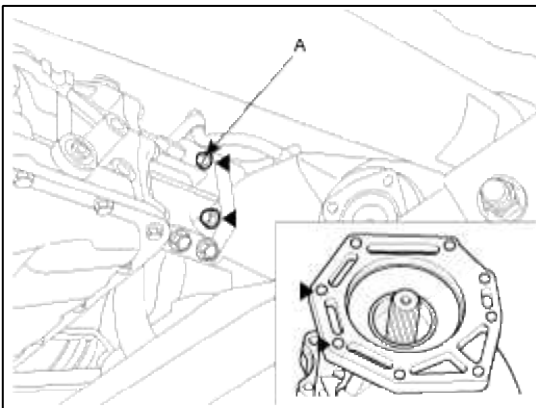
3. Disconnect the speed sensor connector (A) and 4WD connector (B).



4. Remove the transfer assembly by removing the mounting bolts (8ea) from the transmission side.

**NOTE**

Location of the bolts refers to the illustration of contacting surface of the transmission assembly.



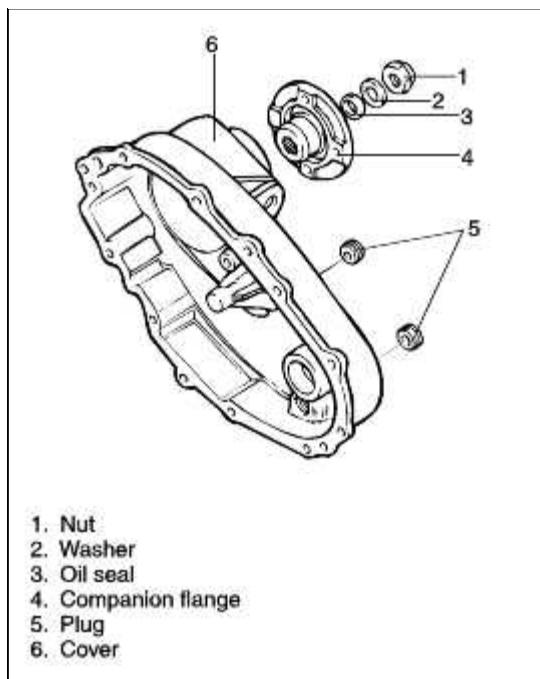
## DISASSEMBLY

### COMPANION FLANGE

**NOTE**

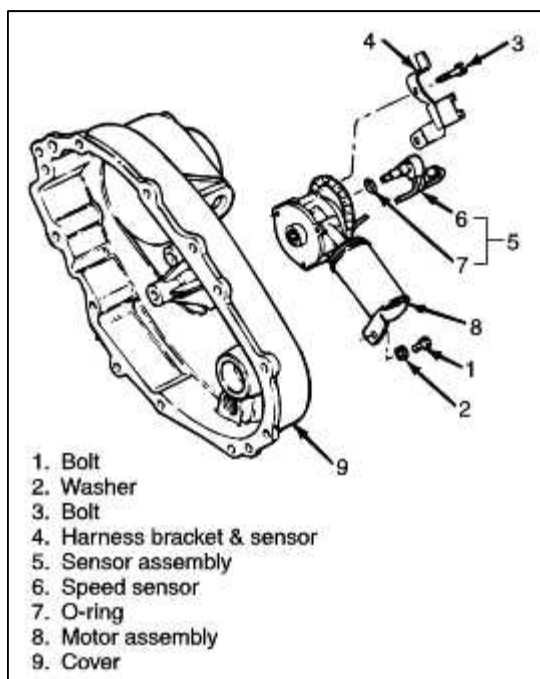
Position transfer case on work bench with rear or cover side up.  
Use wooden blocks under front to keep assembly level.

1. Remove nut and washer.
2. Pull companion flange.
3. Remove oil seal.
4. If installed, remove two plugs from cover.



### EXTERNAL ELECTRIC SHIFT

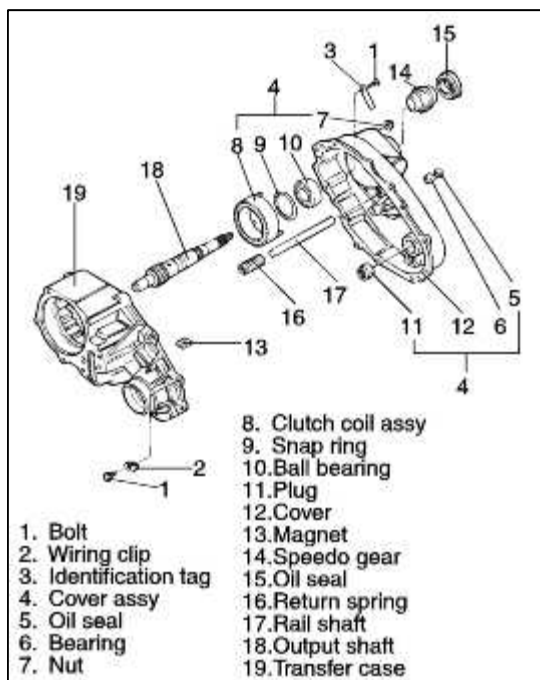
1. Remove bolt (1).
2. Remove three bolts (3).
3. Remove sensor and harness bracket.
4. Remove speed sensor assembly.
5. Remove motor assembly.



### COVER ASSEMBLY

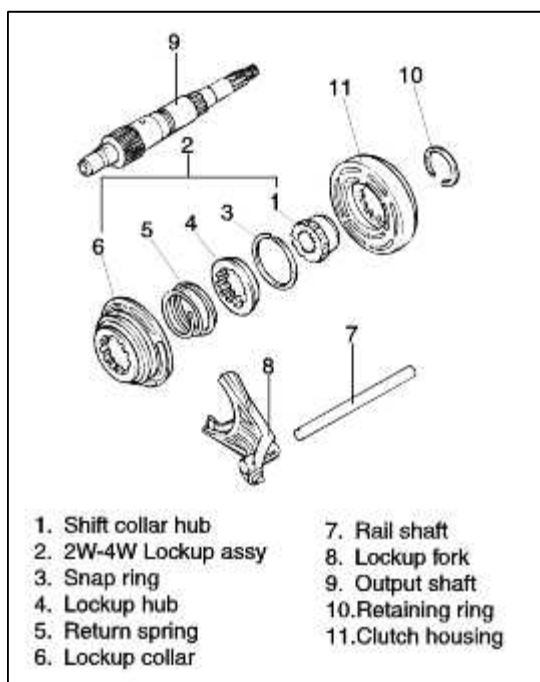
1. Remove nine bolts (1). This will free wiring harness clip and identification tag. Use care not to lose identification tag.  
It contains information required for ordering replacement parts.
2. Pry at the bosses provided on the cover and transfer case to break the sealant bond loose. Then, lift cover assembly straight up to remove.
3. On electric shift units, remove oil seal (5), bearing, three nuts and clutch coil assembly.
4. Remove snap ring and pull ball bearing from cover. This will free speedo gear.
5. Pull needle bearing from cover.

6. Pull oil seal (15) from cover.
7. Remove magnet from slot in case.
8. Remove return spring from rail shaft.
9. Scrap and clean sealant from mating faces of cover and transfer case. Use care not to damage metal faces or allow scrapings to fall into transfer case.



## LOCK SHIFT

1. From electric shift only, remove retaining ring and slide clutch housing from shift collar hub.
2. Remove shift collar hub from output shaft.
3. Together, slide 2W-4W lockup assembly and lockup fork from output shaft and rail shaft. Separate assemblies and remove rail shaft.
4. To disassemble 2W-4W lockup assembly, remove snap ring, lockup hub and return spring from lockup collar.
5. One-piece, plastic lockup fork replaces earlier fork assembly with metal fork and separate roller parts.

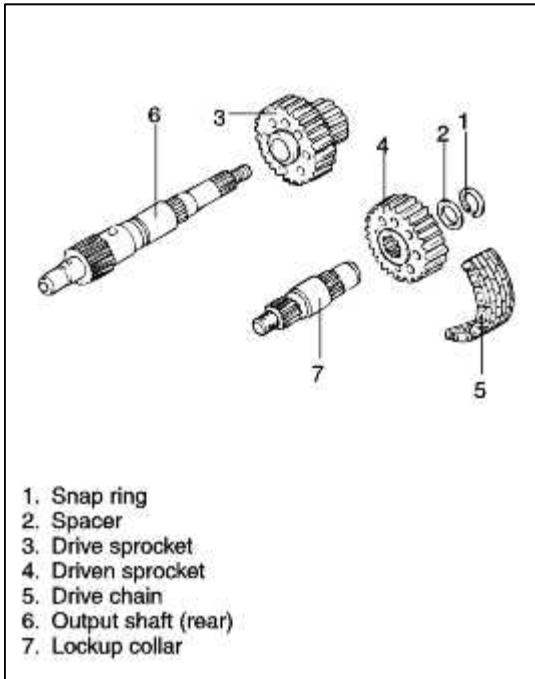


## CHAIN DRIVE

1. Remove snap ring and spacer from output shaft (front).

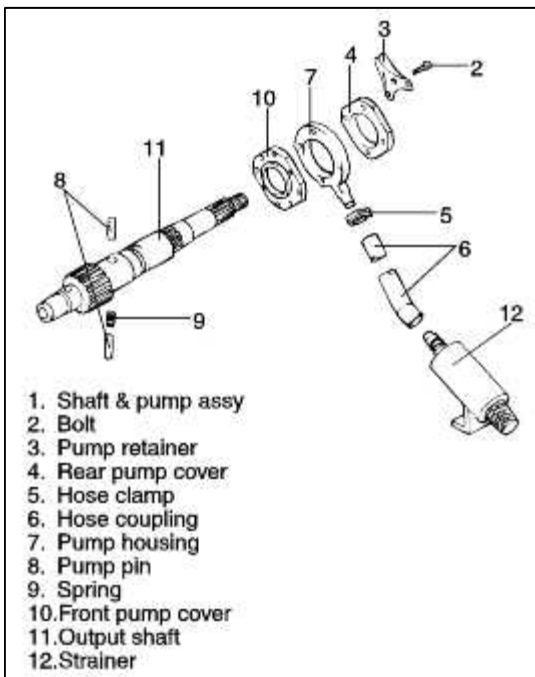


2. Together, slide drive sprocket, driver sprocket and drive chain from output shafts (rear and front). Separate sprockets and chain when out of assembly.



## OIL PUMP

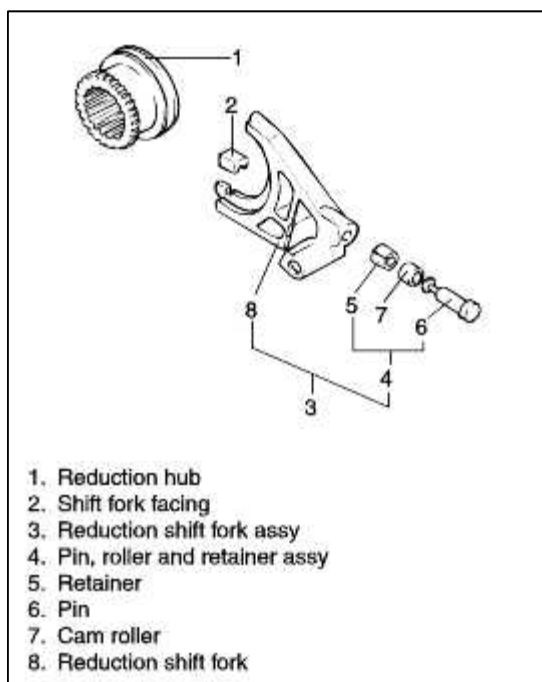
1. Remove four bolts (2) and retainer.  
Slide rear pump cover off output shaft.
2. Loosen hose clamp and separate hose coupling from pump housing.  
Slide pump housing off output shaft.
3. Remove hose clamp, hose coupling and strainer.
4. Remove two pump pins and spring from output shaft.
5. Slide front pump cover off output shaft and remove output shaft.



## REDUCTION SHIFT

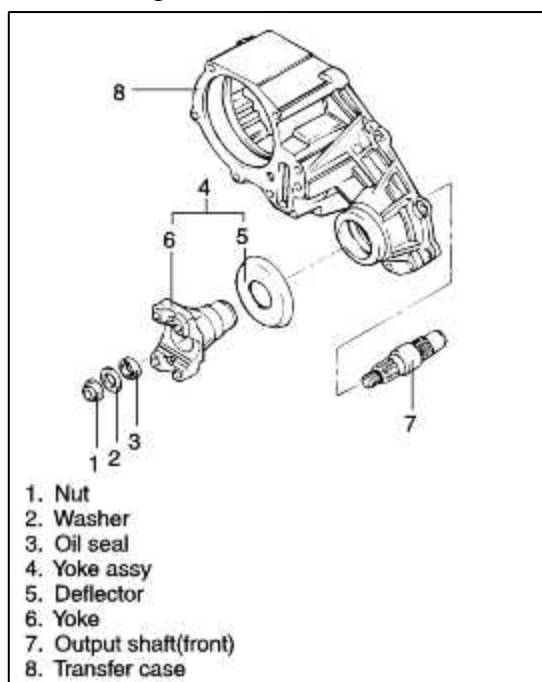
1. Remove reduction hub and reduction shift fork assembly from transfer case.
2. Remove two facings from shift fork assembly.

3. Disassemble fork assembly only if parts replacement is required.  
Cut plastic retainer to remove, freeing pin and cam roller.



#### FRONT OUTPUT SHAFT

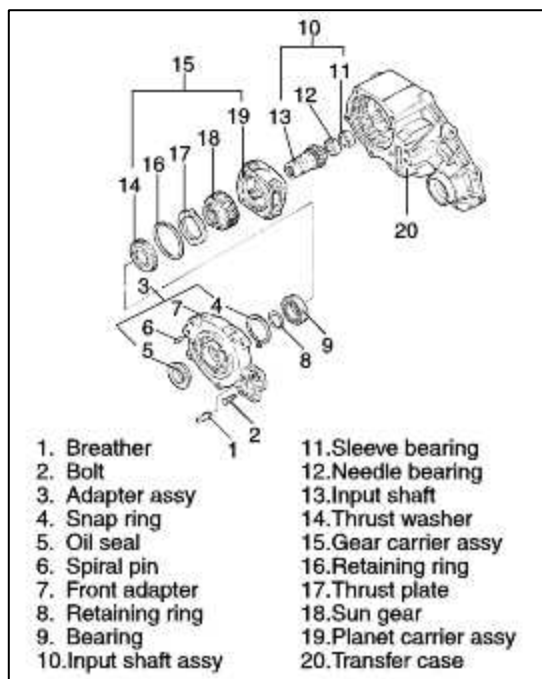
1. Hold yoke and remove nut and washer.  
Pull yoke assembly and oil seal.
2. Press deflector from yoke only if replacement is required.
3. Remove output shaft.



#### ADAPTER, INPUT SHAFT AND GEAR CARRIER

1. Remove breather.
2. Remove six bolts (2).  
Carefully pry front adapter up to break sealant band with transfer case. Use care not to damage adapter or case.
3. Remove adapter assembly, input shaft assembly and gear carrier assembly as an assembled group.
4. Holding end of input shaft on workbench press down on adapter while expanding long ends of snap ring.
5. Remove snap ring and pump oil seal from front adapter.  
Remove pin only if replacement is required.

6. Remove retaining ring (8). Pull bearing and thrust washer from end of input shaft assembly. Remove input shaft assembly from gear carrier assembly.
7. To disassemble input shaft assembly, pull sleeve bearing and needle bearing from input shaft.
8. Remove retaining ring (16), thrust plate end sun gear from planet carrier assembly.

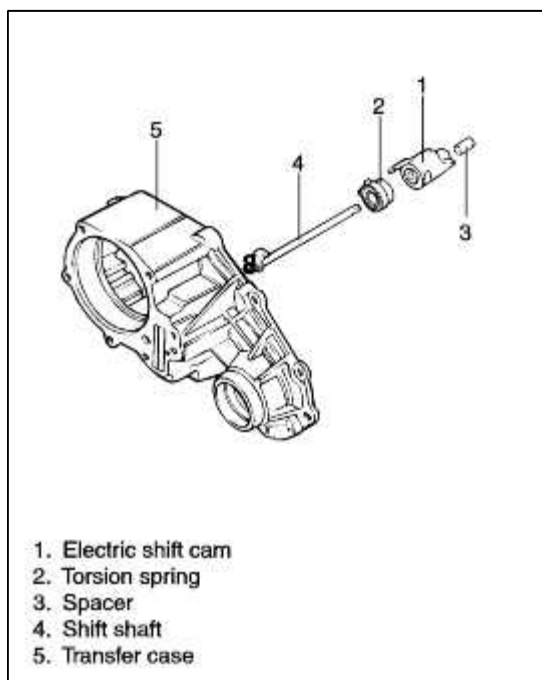


#### SHIFT CAM (Electric parts)

1. Remove electric shift cam group (1 through 4) from transfer case as an assembly.
2. Slide electric shift cam off shift shaft.
3. Clamp retainer end of shift shaft.

Keeping fingers away from spring ends, pry torsion spring out of engagement with shaft drive tang using a screwdriver.

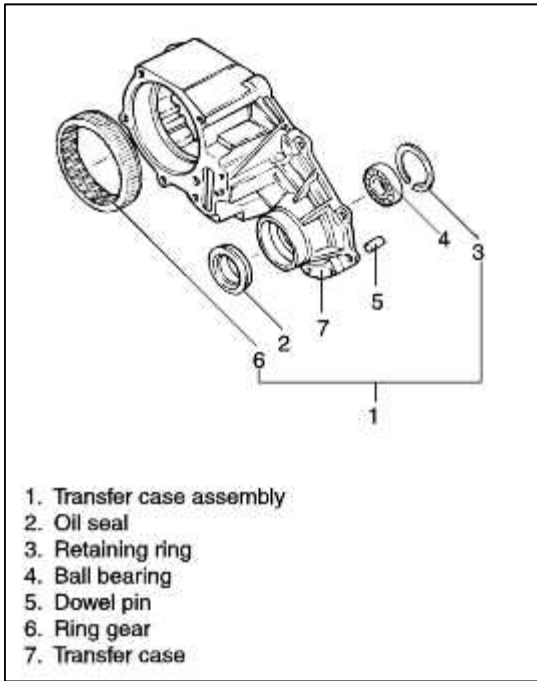
4. Remove torsion spring and spacer from shift shaft.



#### CASE ASSEMBLY

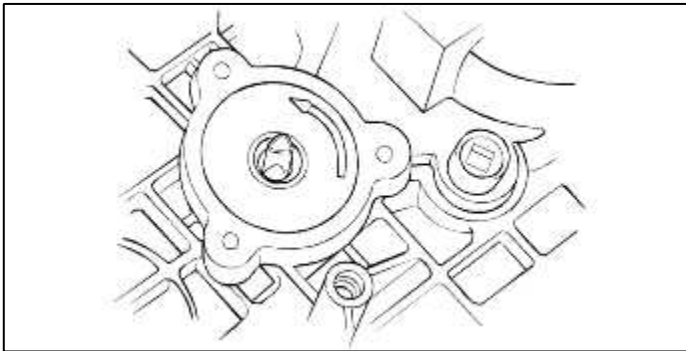
1. Pull oil seal.
2. Remove retaining ring and pull ball bearing.
3. Remove dowel pins from transfer case only if they are loose or damaged.

4. Press ring gear out of transfer case only if ring gear must be replaced.



## DISASSEMBLY

1. Remove the transfer case from the vehicle.
2. Remove the flange washer and nut.
3. Disconnect the shift motor/clutch coil connector and the speed sensor connector.
4. Remove the outer tube of the speed sensor connector wire.
5. Remove the wire fixing cap in the rear of the speed sensor connector.
6. Disconnect the speed sensor connector.
7. Remove the shift motor.

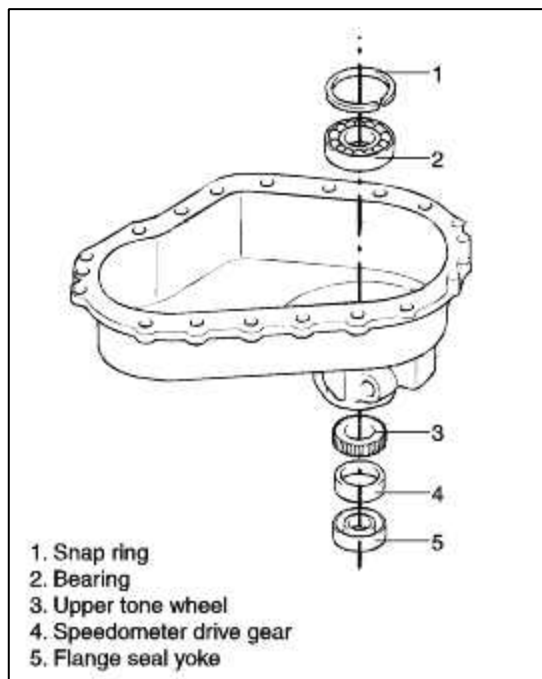


8. If necessary, remove the front and rear speed sensor.
9. Remove the mounting bolts for the rear and front case.
10. Make sure that the front case is facing downward so that the rear cover is facing upwards.
11. Separate the front case from the rear case.
12. Remove all traces of gasket sealant from the mating surfaces of the front case and rear case.

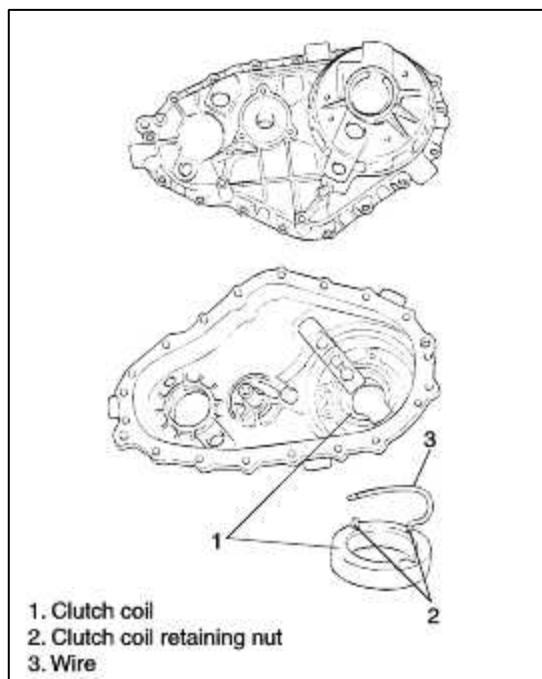
13. If the speedometer drive gear is to be replaced, first remove the flange seal or use the Impact Slide Hammer to pop off the flange seal.

**CAUTION**

Do not damage the bearing and the bearing case.

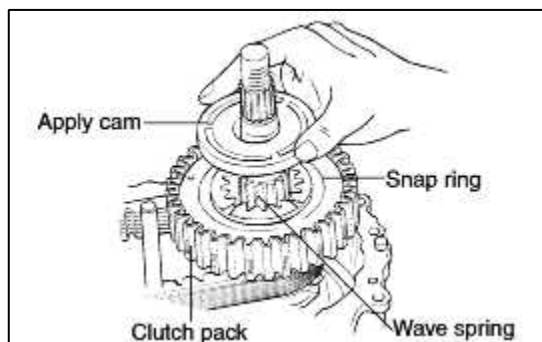
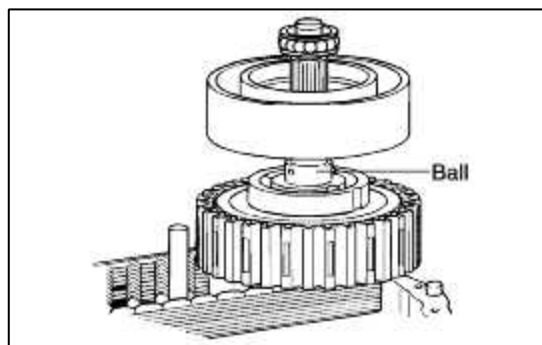


14. Remove the speedometer drive gear and upper tone wheel.  
15. If the rear output shaft bearing requires replacing, remove the internal snap ring that retains the bearing in the bore.  
16. From the outside of the case, drive out the bearing.  
17. Remove the three nuts and washers retaining the clutch coil assembly to the rear case.  
18. Pull the coil assembly, along with the O-rings and wire, from the case.

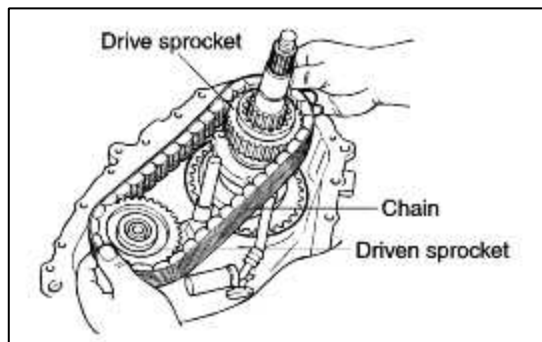


19. Remove the bearing assembly from the output shaft.  
20. Remove the clutch housing from the output shaft.  
21. Remove the balls and the apply cam and the waver washer from the output shaft.  
22. Remove the snap ring from the output shaft.

23. Remove the clutch pack and lower tone wheel from output shaft.



24. Remove the chain, the driven sprocket and the drive sprocket as an assembly.



25. Remove the thrust washer from the output shaft.

26. Remove the oil pan magnet from the slot in the front of the case bottom.

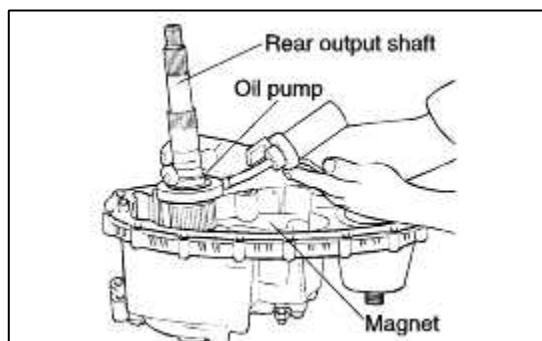
27. Remove the output shaft and oil pump as an assembly.

28. If required, to remove the pump from the output shaft, rotate the pump to align.

29. Pull out the shift rail.

30. Remove the helical cam from the front case.

31. If required, remove the helical cam, torsion spring and sleeve from the shaft.



32. Remove the high-low range shift fork and collar as an assembly.

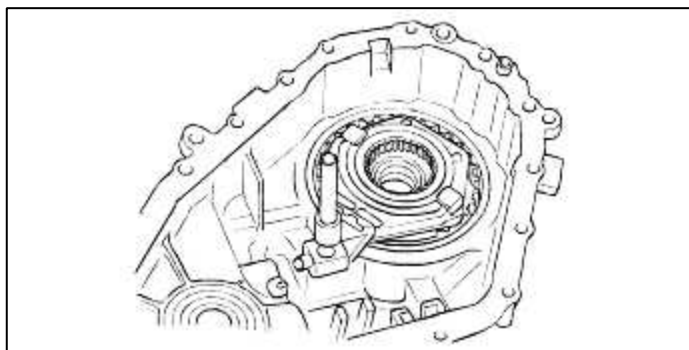
33. Expand the tangs of the large snap ring in the case using the Ring Plier or equivalent.

34. With the input shaft against a bench, push the case down and slide the main drive gear bearing retainer off the bearing.

35. Lift the input shaft and front planet from the case.

36. If required, remove the oil seal from the case by prying and pulling on the curved-up lip of the oil seal or use the Slide Hammer to pop off the oil seal.

37. Remove the internal snap ring from the planetary carrier.
38. Separate the front planet from the input shaft.
39. Remove the external snap ring from the input shaft.
40. Place the input shaft in a vise and remove the bearing.
41. Remove the thrust, thrust plate and the sun gear off the put shaft.



42. Inspect the bushing and needle bearing in the end of the input shaft for wear or damage.

#### CAUTION

Under normal use, the needle bearing and bushing should not require replacement.

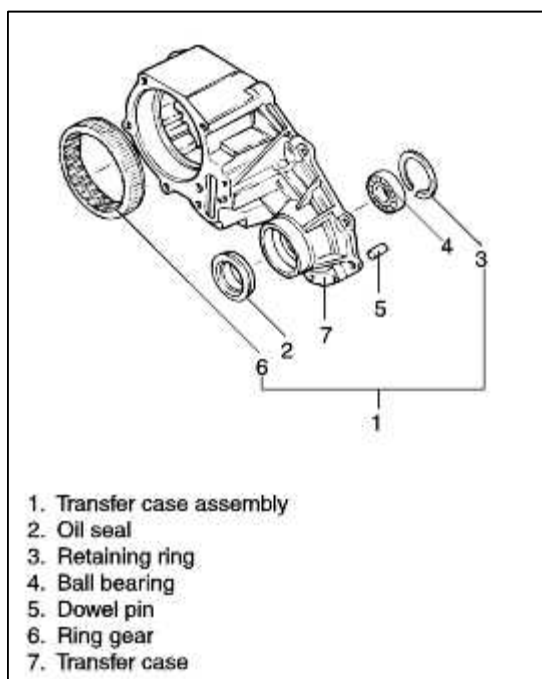
If replacement is required, the bushing and needle bearing must be replaced as a set.

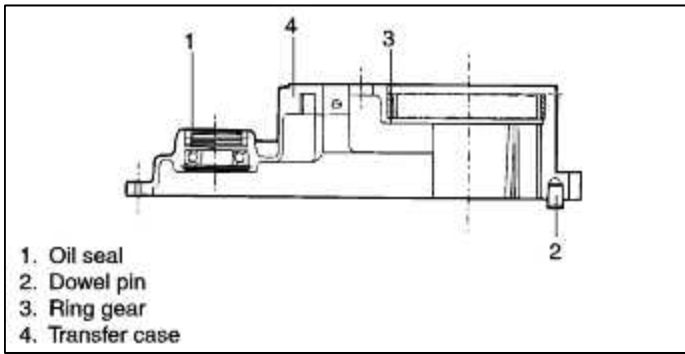
43. If required, remove the front yoke to flange seal by prying and pulling on the curved-up lip of the yoke to flange seal.
44. If required, remove the internal snap ring retaining the front output shaft ball bearing and remove the bearing.

## REASSEMBLY

### CASE ASSEMBLY

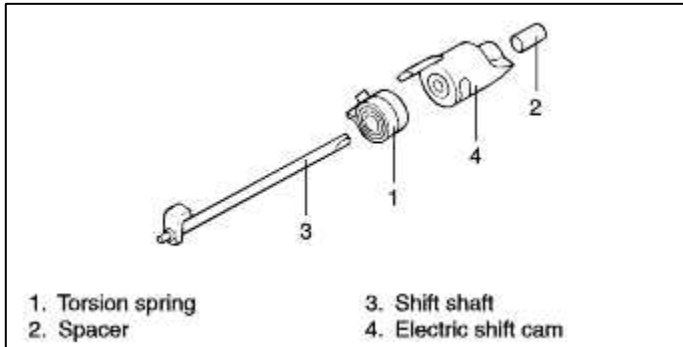
1. If ring gear was removed for replacement, align serrations on OD of new ring gear with those in transfer case. Press in ring gear, chamfered end first. Make sure gear is not cocked and is firmly seated in case.
2. If removed, press two new dowel pins into case.
3. Press in ball bearing to bottom in transfer case and install retaining ring.
4. Position new oil seal and press in to seat seal flange against transfer case.



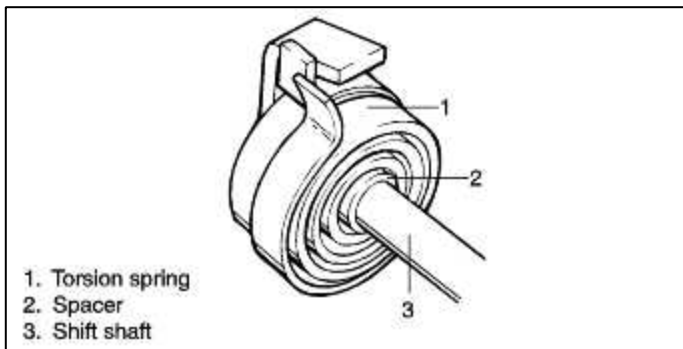


### SHIFT CAM (ELECTRIC PARTS)

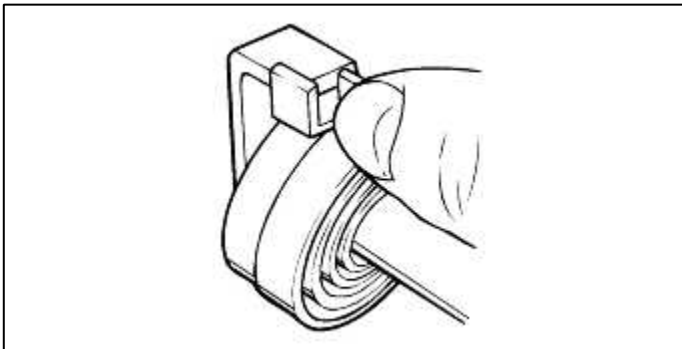
1. Insert spacer in torsion spring and install over free end of shift shaft.



2. Slide torsion spring and spacer on shift shaft up to drive tang and position first spring end to left (Viewed from free end of shaft) of drivetang.



3. Twist second spring end to right of drive tang on shift shaft.

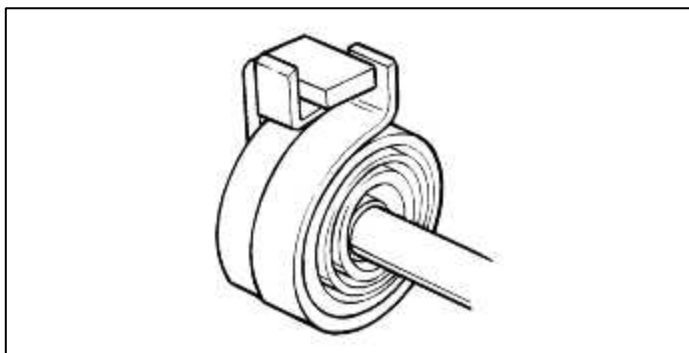


4. Push torsion spring and spacer together back as far as they will go.



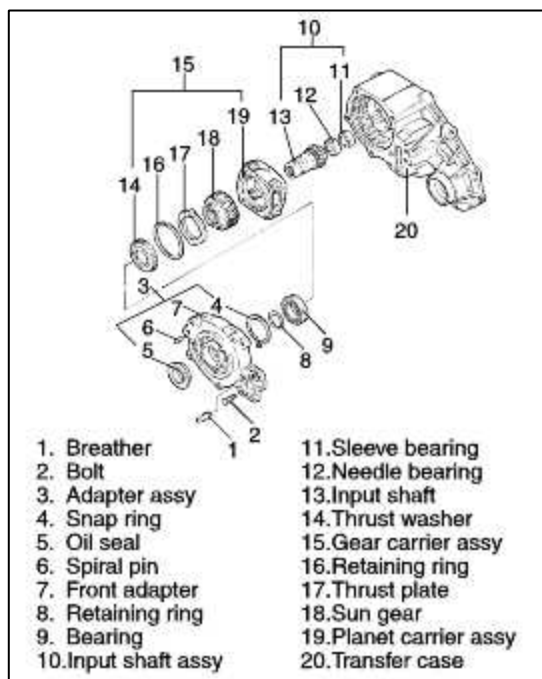
- Slide electric shift cam onto shift shaft, drive tang on cam first.

Position drive tang on cam so that it will go under drive tang on shift shaft and between spring ends and slide cam as far as it will go.



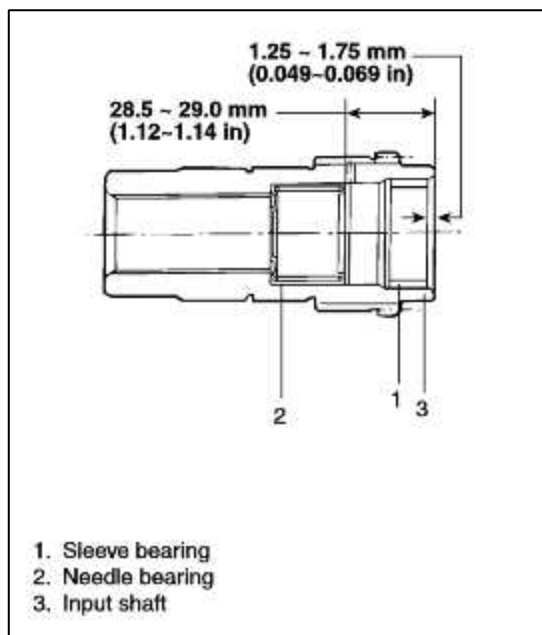
#### ADAPTER, INPUT SHAFT AND CARRIER

- Lay planet carrier assembly on work bench with end having groove for retaining ring up.
- Install sun gear with hub end up. Rotate gear of planet carrier assembly as required until sun gear is fully meshed.
- Align tabs and install thrust plate into planet carrier assembly.
- Install retaining ring (16) to complete gear carrier assembly.



- If removed, position needle bearing and press into input shaft to dimension shown. Press in new sleeve bearing to complete input shaft assembly.
- Lift up gear carrier assembly and install input shaft assembly up through gear carrier assembly. Install thrust washer and press bearing over end of input shaft assembly. Retain bearing on input shaft with retaining ring in shaft groove.
- If removed, press new pin into front adapter.
- Position oil seal and press into front adapter to dimension shown.
- Install snap ring in groove in front adapter with long ends of snap ring in adapter groove to complete front adapter assembly.

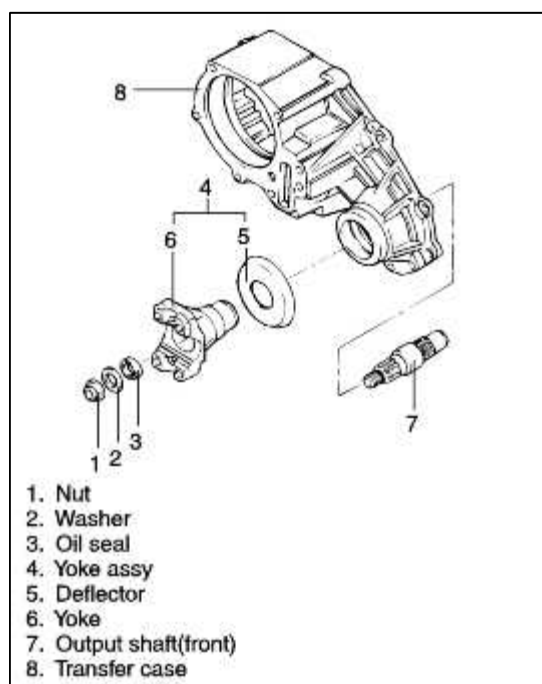
10. Position front adapter assembly with face that mates with transfer case up. Support on wood blocks to provide clearance for input shaft assembly. Position assembled input shaft and carrier group over front adapter with input shaft down. Lower shaft and carrier group while expanding long ends of snapping until snap ring engages groove in outside diameter of bearing.



11. Apply continuous 1/16 in.(1.6 mm) bead of sealant (Neutral Cure RTV, Loctite 598) all around transfer case mounting facefor front, adapter. Center sealant bead between edges of face. Circle bolt holes.
12. Install assembled adapter, input shaft and carrier group on transfer case and attach with six bolts. Torque bolts to 20 - 34 lb·ft (27 -46 Nm)
13. Install breather bard and torque to 6 - 14 lb·ft (8 - 19 Nm).

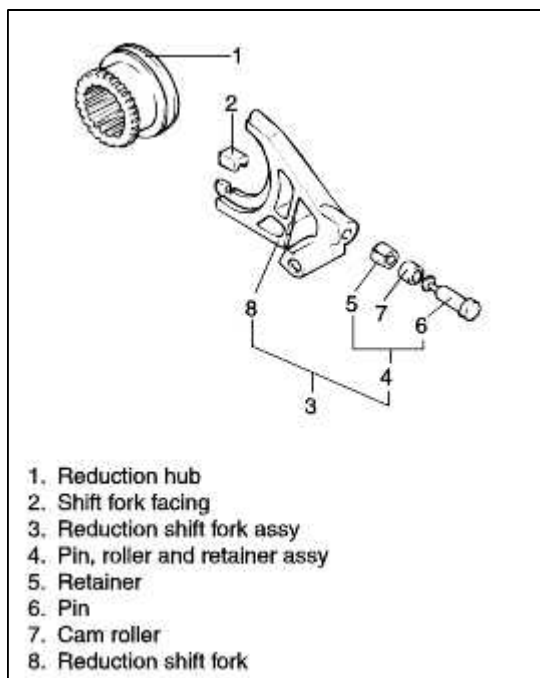
#### FRONT OUTPUT SHAFT

1. If removed, press deflector onto yoke.
2. Position output shaft in transfer case and install yoke assembly, oil seal, washer and nut.
3. Hold yoke and torque nut to 150 - 180 lb·ft (203 - 244 Nm).



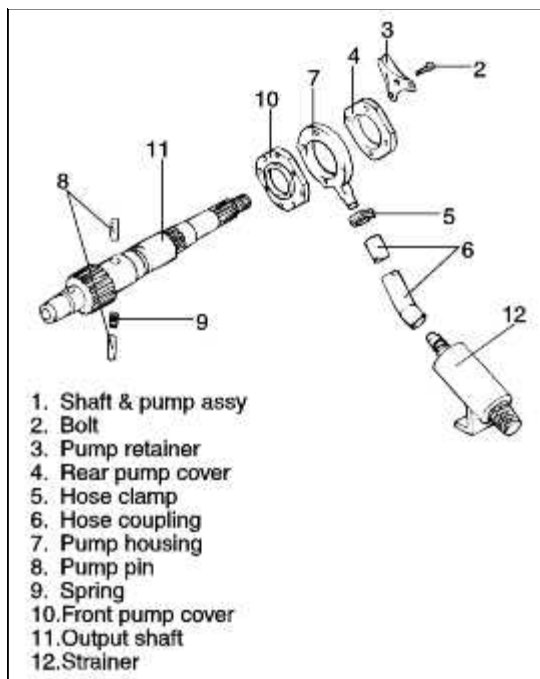
#### REDUCTION SHIFT

1. If disassembled for parts replacement, assemble reduction shift fork assembly using new pin, roller and retainer assembly.  
Press pin, roller and retainer assembly in to bore in reduction shift fork until retainer passes completely through and snaps in place. Make sure that cam roller turns freely.
2. Install two fork facings on reduction shift fork assembly.
3. Engage reduction shift fork assembly with reduction hub and position in transfer case, reduction hub in gear carrier assembly previously installed.
4. Install output shaft, engaging output shaft end with input shaft bearings and output shaft spline with reduction hub.



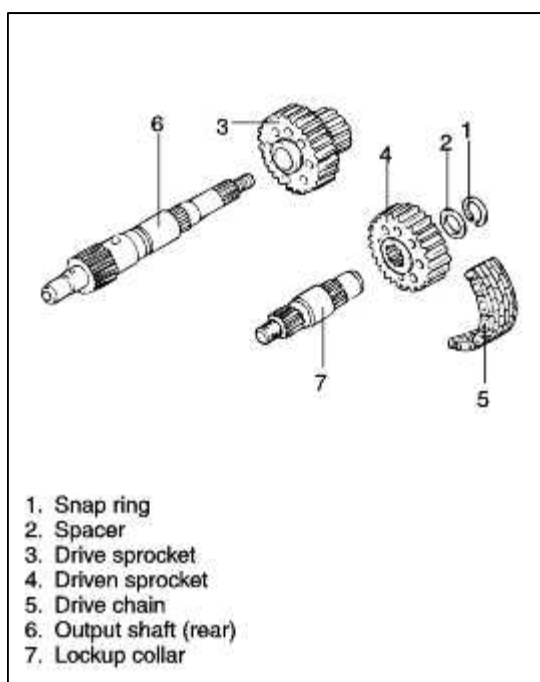
## OIL PUMP

1. Locate pump front cover. Front pump cover has tapped holes.  
Position front cover so that word TOP faces down and turned so that it will be at top of transfer case when installed in vehicle.  
Install front pump cover over output shaft in this position.
2. Install two pump pins with spring between them in output shaft.  
Flat surface on both pins must point out and face up. Center pins and spring in output shaft.
3. Push hose coupling onto bard on strainer and install L shaped foot on filter in slot in transfer case. Hose coupling must point in direction of pump assembly.
4. Install pump housing so that word REAR marked on it is up and hose bard points toward hose coupling and strainer. Lower pump housing over upper output shaft, moving pump pins inward and compressing spring so that both pins are contained inside pump housing.
5. Slip hose clamp over free end of hose coupling and push onto hose bard on pump housing. Secure hose clamp over hose coupling on hose bard.
6. Position pump rear cover over assembly with words TOP REAR facing up and located to be at top of transfer case when installed.  
Position pump retainer on cover so that tab on retainer is in notch in transfer case. Clean threads on four bolts and apply Loctite 222. Align pump holes and install bolts. Torque bolts to 2.9 - 6.3 lb·ft (4.0 - 8.5 Nm) while turning output shaft by hand to insure that pump pins move freely.



### CHAIN DRIVE

1. On work bench, next to transfer case assembly, position driven sprocket (with internal spline) at front output shaft end of case and drive sprocket (with smooth bore) at output shaft end.
2. Assemble drive chain around sprockets.
3. Grasp each sprocket, hold drive chain tight and parallel with transfer case, and install chain drive assembly over output shaft. It may be necessary to rotate driven sprocket slightly to engage splines on front output shaft.
4. Install spacer on front output shaft. Install snap ring in shaft groove over spacer.

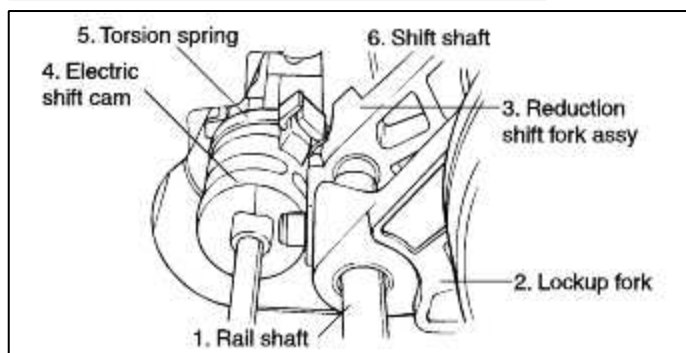
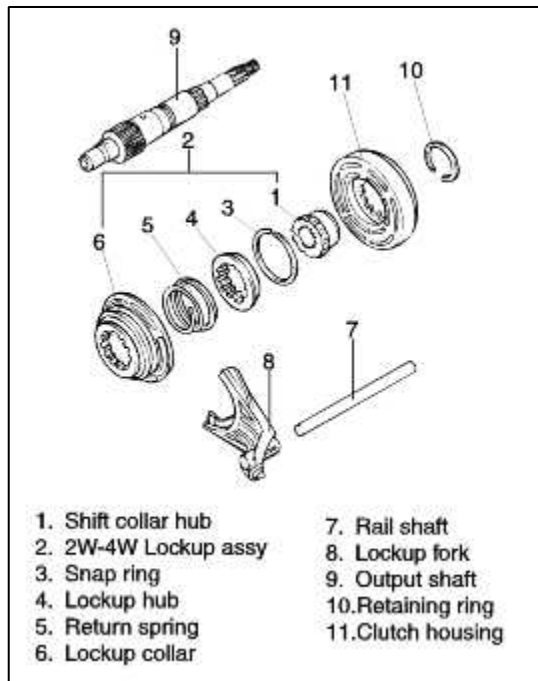


### LOCKUP SHIFT

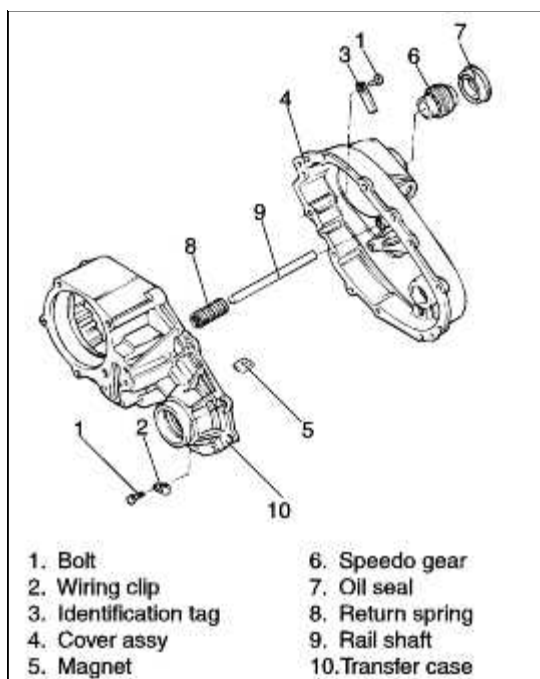
1. Assemble return spring and lockup hub in lockup collar and retain with snap ring, completing 2W-4W lockup assembly.
2. Install rail shaft in transfer case, through reduction shift fork assembly previously installed and into blind hole in case.
3. Engage lockup fork in groove in 2W-4W lockup assembly and slide this group down over output shaft and rail shaft.
4. Install shift collar hub, engaging splines on output shaft and in 2W-4W lockup assembly.

5. On electric shift units only, install electric shift cam group previously assembled and clutch housing as follow :

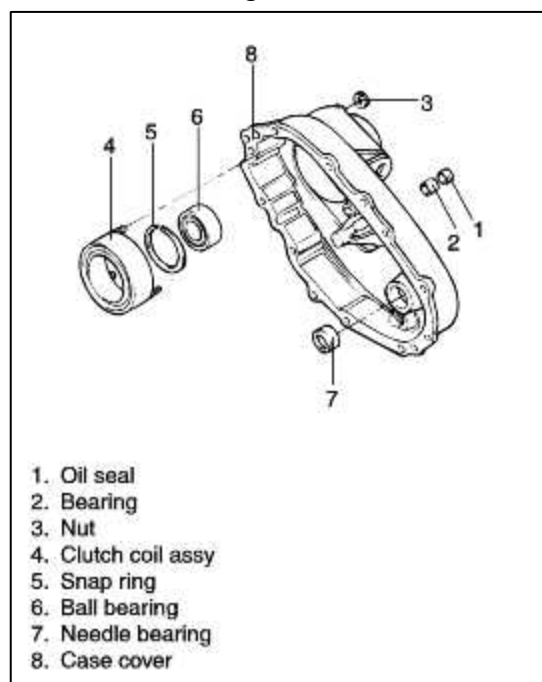
- (1) Position electric shift cam group rotated so that end of torsion spring will contact side of reduction shift fork assembly that faces up, towardtop of case.
- (2) Holding rail shaft down, raise up fork assemblies slightly. Rotate electric shift cam group into position so that rolleron reduction shift fork assembly is in groove in shift cam and button on lockup fork is on cam end. Then lower this group of parts into the transfer case engaging shift shafton pin in transfer case.
- (3) Position clutch housing in transfer case over shift collar hub. Attach with retaining ring in clutch collar hub groove.



CASE COVER

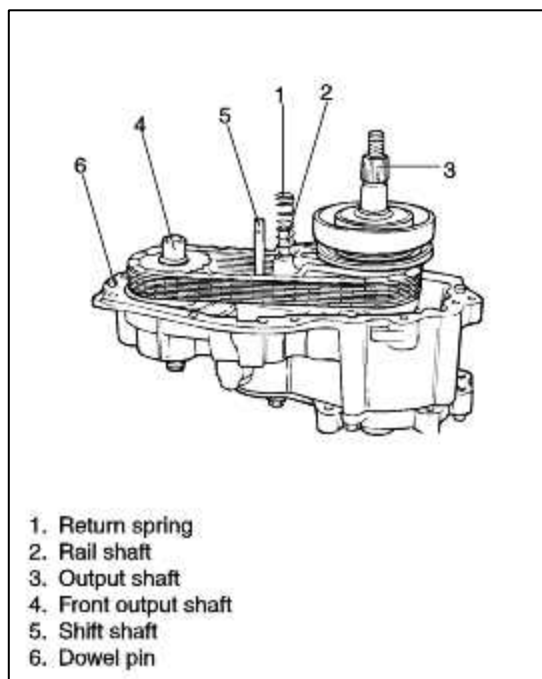


1. Position cover on bed of suitable press so that open face of cover is up and parallel with press bed.
2. Position end of needle bearing with identification marking up and press into cover until upper end of bearing is 1.593 -1.603 in. (40.47 -40.97 mm) below face of cover that mates with transfer case.
3. Press in ball bearing to bottom in cover and install snap ring.
4. On electric shift units only, install parts as follow :
  - (1) Verify that four O-rings (one on wire and one each on three studs) are in place on clutch coil assembly. Install clutch coil assembly in inside of cover, with electrical wire and studs extending through cover, with electrical wire and stud extending through cover. Use care not to kink or trap electrical wire under clutch coil assembly. Attach with three nuts and torque to 6 -8 lb·ft (8 - 11 Nm).
  - (2) Install motor bearing and oil seal in cover.

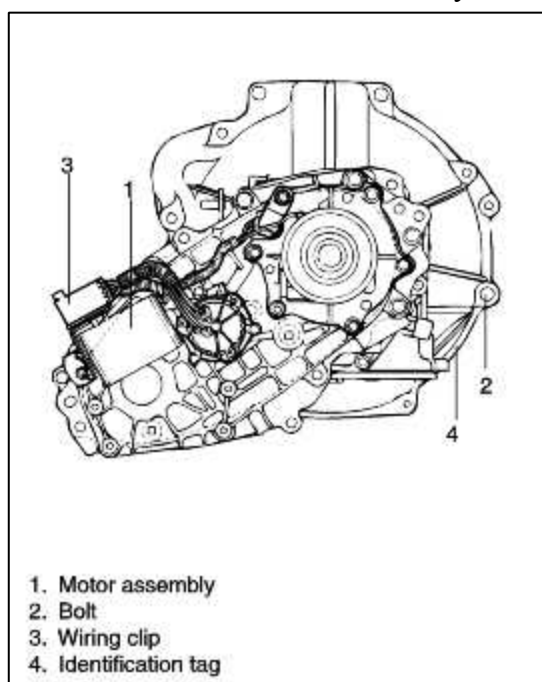


5. Install return spring over rail shaft in transfer case to rest on shift fork.
6. Install magnet in slot in transfer case.

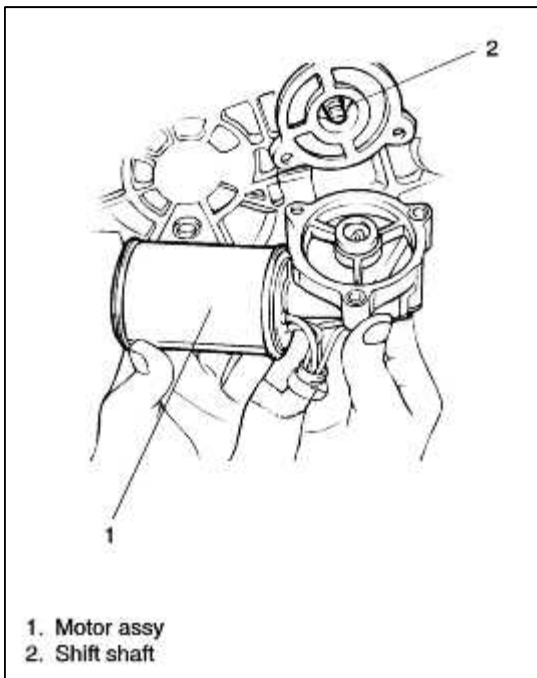
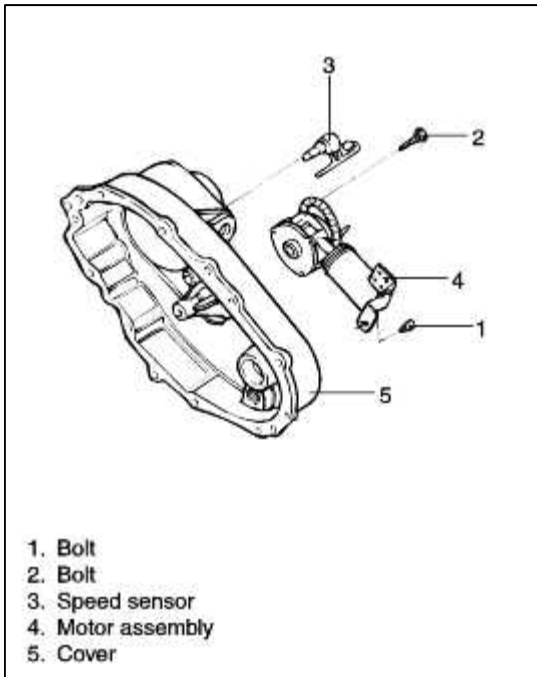
7. Apply continuous 1/16 in. (1.6 mm) bead of sealant (Neutral Cure RTV, Loctite 598) all around transfer case mounting face for cover assembly. Center sealant bead between edges of face. Circle bolt holes. Remove excess sealant bead is larger than 1/16 in. (1.6 mm).



8. Install cover assembly on transfer case. All of the following alignment conditions must be met for the cover assembly to seat on transfer case properly.
- (1) Cover holes with transfer case dowel pins.
  - (2) Cover bearings with output shafts.
  - (3) Blind hole in cover with rail shaft. Make sure spring is not cocked. On electric shift, check with pen light through cover hole for speed sensor.
  - (4) On electric shift units, cover bearing with shift shaft.
9. Install nine bolts positioning identification tag and wiring clip under bolt heads at locations. Torque bolts to 20 - 34 lb·ft (27 -46 Nm).
10. Install speed gear over spline of output shaft into cover assembly.
11. Press new oil seal into cover assembly.



1. Position motor assembly so that triangular slot in motor will align with shift shaft. Move motor in to engage shift shaft and contact cover. Then rotate motor in clockwise direction until motor is in correct position and mounting holes are aligned.
2. Fit O-ring on speed sensor and install speed sensor assembly in cover. Install bracket so that it is over speed sensor and install three bolts. Torque bolts to 6 - 8 lb·ft (8 - 11 Nm).
3. Install bolt and washer at bracket end of motor assembly and torque to 6 - 8 lb·ft (8 - 11 Nm).

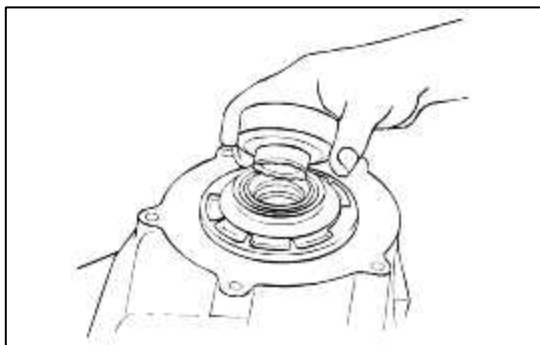


## REASSEMBLY

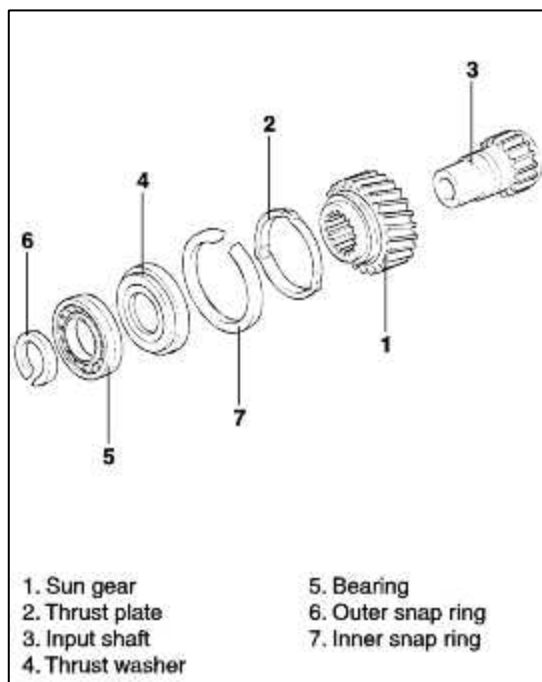
1. Before assembly, lubricate all parts with the specified grease oil.
2. If removed, drive the bearing into the front output case bore.
3. Install the internal snap ring that retains the bearing to the front case.
4. If removed, install the front yoke to flange seal in the front case bore.



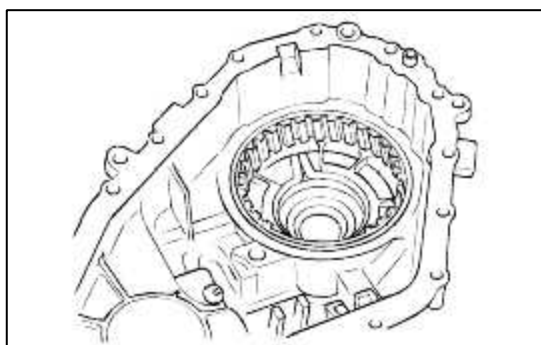
5. If removed, install the yoke to flange seal into the mounting adapter bore.



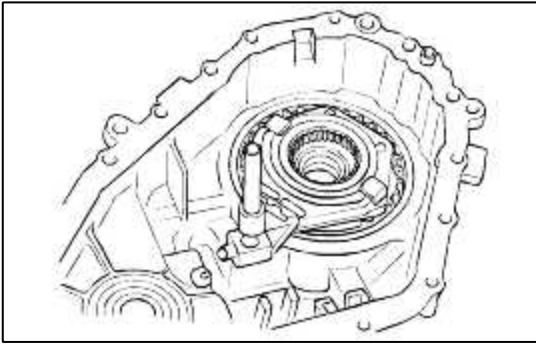
6. If the input shaft needle bearing and bushing were removed, install a new bearing and bushing.  
 7. The recessed face of the sun gear and the snap ring groove on the bearing outer race should be toward the rear of the transfer case.  
 8. The stepped face of the thrust washer should face toward the bearing.  
 9. Slide the sun gear, thrust plate and thrust washer into position on the input shaft.  
 10. Press the bearing over the input shaft.  
 11. Install the external snap ring to the input shaft.  
 12. Install the front planet to the sun gear and input shaft.  
 13. Install the internal snap ring to the planetary carrier.



14. Place the tanged snap ring in the case.  
 Expand the snap ring with the snap ring pliers and install the planetary carrier assembly.  
 Check the installation by holding the case and carefully tapping the face of the input shaft against a wooden block to make sure the snap rings are installed.  
 15. Remove all traces of gasket sealant from the front case and mounting adapter mating surfaces.

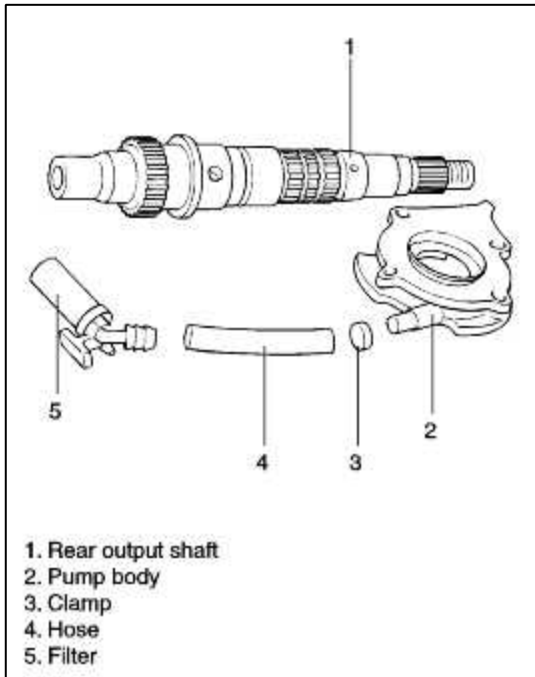


16. Install the high-low shift fork and high-low collar as an assembly into the front planet.

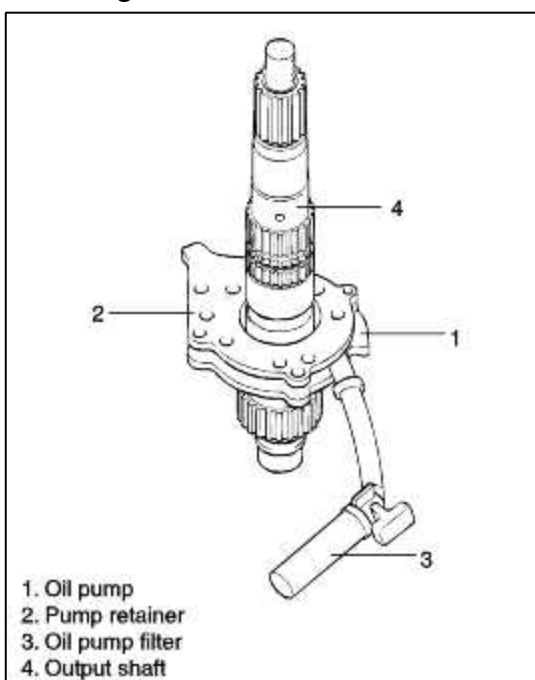


17. Check the pump to make sure the pump rotates freely.

18. Inspect the outside surfaces and bore of the oil pump.

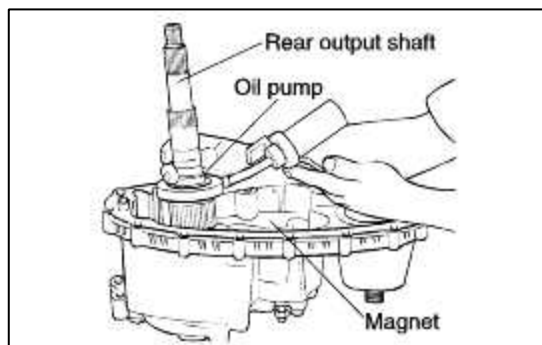


19. Install the output shaft and oil pump in the input shaft. Make sure that the internal splines of the output shaft engage the internal splines of the high-low shift collar. Make sure that the oil pump retainer arm and oil filter leg are in the groove and slot of the front case.



20. Install the oil pan magnet in the slot in the front case just above the oil filter leg.

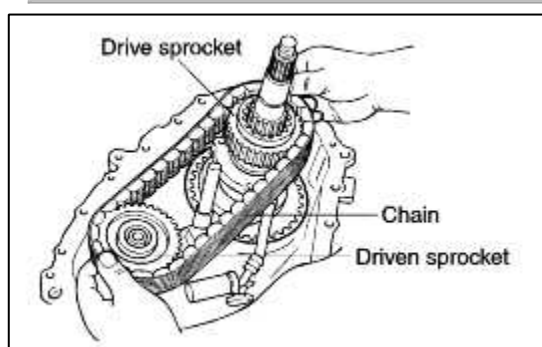
21. Install the front output shaft in the front case.



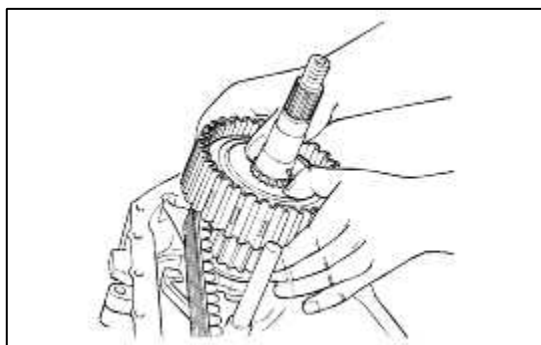
22. Install the thrust washer on the rear output shaft.  
 23. Install the chain, drive sprocket and driven sprocket as an assembly over the output shaft.

**CAUTION**

The driven sprocket (on the front output shaft) must be installed with the marking REAR facing toward the rear case, if so marked.

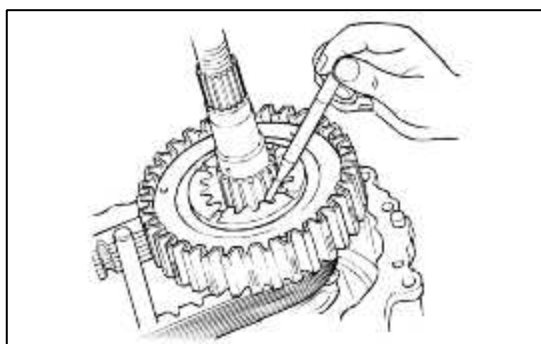


24. Install tone wheel onto the front output shaft. Make sure the spline on the tone wheel engages the spline on the front output shaft.  
 25. Install clutch pack assembly onto the rear output shaft. Make sure that the spline on the clutch pack engages to the spline of the sprocket.



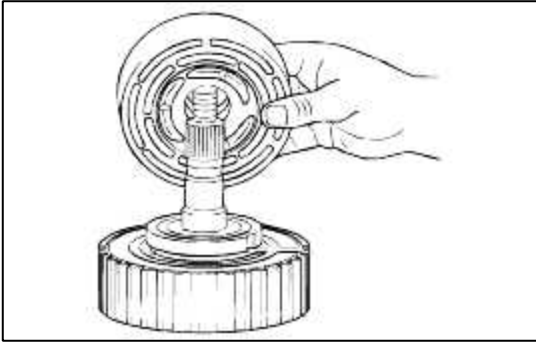
26. Install snap ring onto the rear output shaft. Start the snap ring over the spline and use the wave spring to seat the snap ring in the snapping groove.

If the snap ring will not install, the thrust washer inside the clutch pack may not be seated properly.

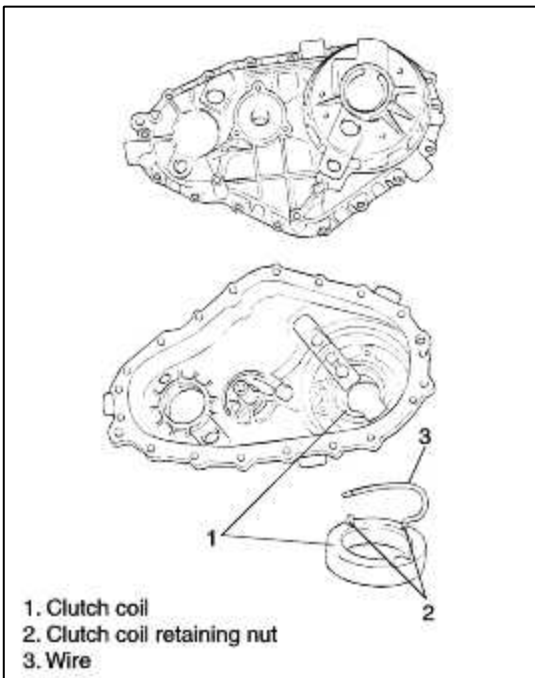


27. Three slots on the thrust washer must be aligned with the three tabs on the clutch pack housing.

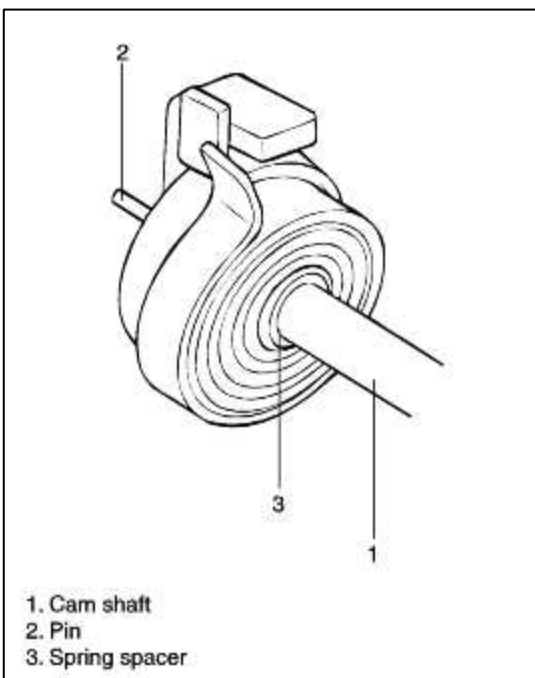
28. Install the apply cam onto the rear output shaft.
29. Install three balls into the apply cam.
30. Install cam and coil housing assembly onto rear output shaft.
31. Install thrust bearing assembly onto output shaft.



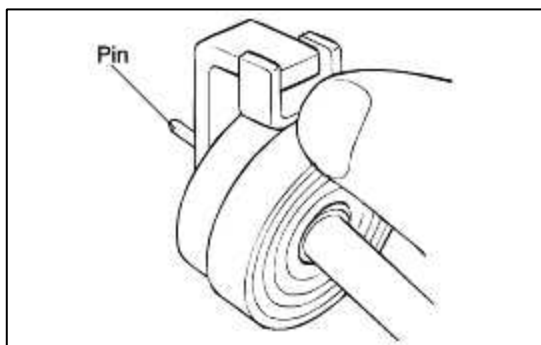
32. Install the clutch coil from inside the rear case until the wire and studs extend through the cover.
33. Install the washers and nuts and tighten to 8 - 11Nm.



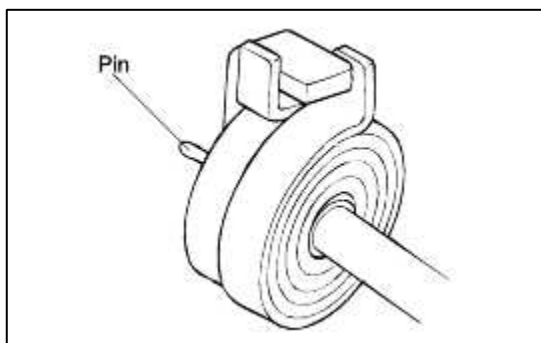
34. Slide the spring spacer on the cam shaft and position it beneath the drive tang.
35. Place the torsion spring on the cam shaft. Position the first spring tang to the left of the cam shaft drive tang.



36. Wind the second spring tang clockwise past the drive tang.



37. Push the torsion spring and sleeve in as far as it will go.  
 38. Install the helical cam and slide the drive tang between the torsion spring tangs as far as it will go.

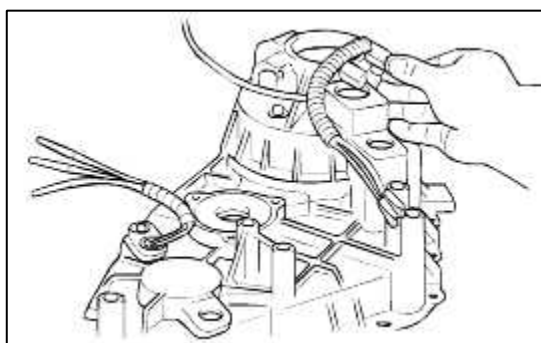


39. Install the pin on the tang end of the helical cam into the hole in the front case.  
 Position the torsion spring tangs so that they are pointing toward the top side of the transfer case and just touching the high-low shift fork.

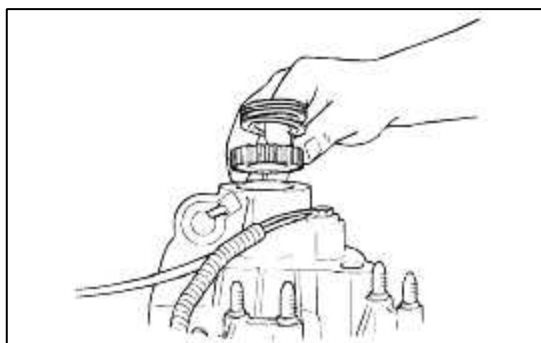
#### CAUTION

Do not bend the helical cam during installation to the front case because of possible damage to the pin at the tang end of the motor shaft.

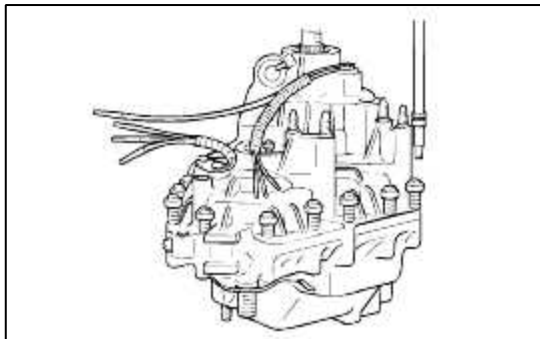
40. Install the shift rail through the high-low shift fork and make sure that the reverse gear shift rail is seated in the front case bore.  
 41. Install upper and lower speed sensors into the cover. Feed the coil wire through the upper speed sensor wire shield.



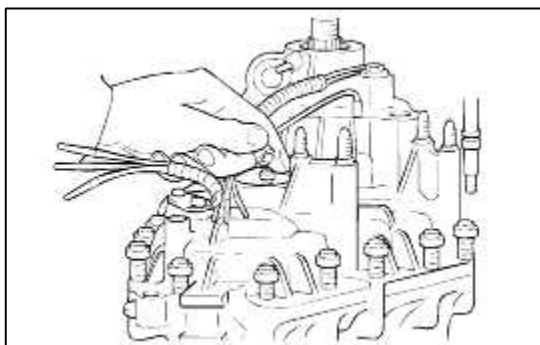
42. Install upper tone wheel, speedometer gear and rear output seal.



43. Coat the mating surface of the front case with sealant.
44. The following procedure must be followed prior to installing the rear case onto the front case half :
  - (1) Align the output shaft with the rear case output shaft bore.
  - (2) Align the helical cam with the rear case motor bore. If difficulty is encountered with seating the rear case, tap the rear output shaft with a sharp blow using a rubber mallet in a direction away from the triangular shaft while pushing down on the rear case.
45. Install the bolts retaining the case halves and tighten to 25 - 37 N·m (250 - 370 kg·cm, 19 - 25 lb·ft).



46. Install shift shaft oil seal if it is not installed.



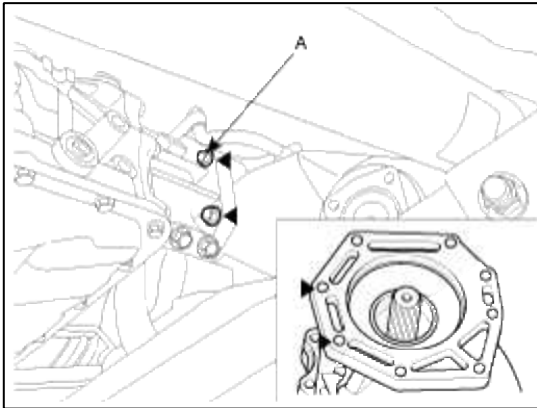
47. Using pliers equipped with soft jaws, rotate the triangular shaft so it is aligned with the triangular slot in the transfer case shift motor. If triangular shaft will not rotate, rotate the rear output shaft.
48. Slightly loosen the two nuts that attach the slotted support bracket to the end of the motor house.
49. Apply the sealant to motor housing base and install on transfer case.
50. Install the transfer case shift motor.
51. Holding the slotted support bracket tight against the motor housing end secure the bracket to the transfer case, tightening the bolt with lockwasher to 8 - 11 N·m (80 - 110 kg·cm, 6 - 8 lb·ft).
52. Retighten the two nuts that attach the slotted support bracket to the end of the motor to 3-4 N·m (30 - 40 kg·cm, 2 - 3 lb·ft).

## Installation

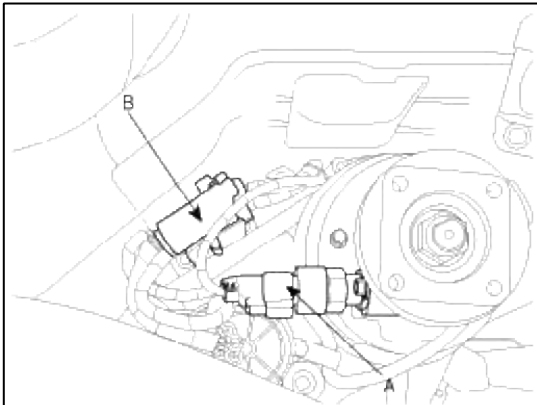
1. Install the transfer assembly by installing the mounting bolts (8ea) from the transmission side.

**NOTE**

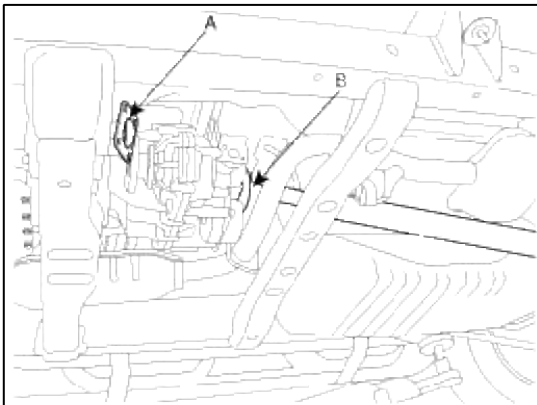
Grease the spline end of the transmission output shaft before installing the transfer assembly.



2. Connect the speed sensor connector (A) and 4WD connector (B).



3. Install the front/rear propeller shaft(A,B).



4. Connect the battery (-) terminal.